INNAMINCKA REGIONAL RESERVE

BIRDS, MAMMALS & VEGETATION SURVEY 2022

CORDILLO DOWNS ROAD

~ REPEAT OF 2017 SURVEY ~

A project undertaken by the Friends of the Innamincka Reserves

2017 **2022**

The Cordillo Downs Road, Innamincka Regional Reserve

REPORT ON THE CORDILLO DOWNS ROAD BIRDS, MAMMALS & VEGETATION SURVEY 2022 – REPEAT OF 2017 SURVEY

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REPORT ON THE CORDILLO DOWNS ROAD BIRDS, MAMMALS & VEGETATION SURVEY 2022 – REPEAT OF 2017 SURVEY

INTRODUCTION

A. PROJECT FIELD TEAM AND COORDINATOR

This project was carried out as a volunteer activity by members of the Friends of the Innamincka Reserves (FOIR). There was no external funding for the project.

Field Team: L to R - Mark Anderson, Jenny Rolland, Merilyn Browne, Euan Moore.
Temporary Ranger IRR, Ross Anderson (inset) assisted with day 1 of the survey.
Project Coordinator: Kate Buckley

B. BACKGROUND

In 2013 FOIR volunteers established a survey method which could be used to monitor the impacts of both short- and long-term changes in environmental conditions on populations of bird, mammal and vegetation species in the Innamincka Regional Reserve. Using this methodology, the volunteers obtained baseline survey data for four 80-110 km spans along roads radiating out from Innamincka - the Bore Track North in 2013[1], the Coongie Road in 2014[2], the Old Strzelecki and Loop Tracks in 2015[3] and the Cordillo Downs Road in 2017[4]. In 2016, high rainfall prevented access to the Reserve for a survey. In 2018, the first repeat survey was performed along the Bore Track North[5] and in 2019, the Old Strzelecki & Loop Tracks survey was repeated[6]. Surveys could not be conducted in 2020-2021 due to COVID restrictions. In this report, results are presented for the third repeat survey - the Cordillo Downs Road - conducted in 2022 using the same methodology at the same sites as in the 2017 survey. Once again, a repeat of the Coongie Rd survey was not possible due to road closure following recent flooding.

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[1] FOIR Bore Track North Survey Project Report 2013
[2] FOIR Coongie Road Survey Project Report 2014
[3] FOIR Old Strzelecki and Loop Tracks Survey Project Report 2015
[4] FOIR Cordillo Downs Road Survey Project Report 2017
[5] FOIR Bore Track North – Repeat of 2013 Survey Project Report 2018
[6] FOIR Old Strzelecki & Loop Tracks – Repeat of 2015 Survey Project Report 2019

The Cordillo Downs Road links Birdsville and Innamincka. At the end of July in 2017, surveys were carried out along the northern part of the road within the Innamincka Regional Reserve. The survey route encompassed a range of habitat types within or on the edge of the Marqualpie Land System, including dry open woodlands and grasslands, dune systems and wetlands as well as gibber plains.

While average rainfall is low (178 mm per annum), the Innamincka area is in a region of maximum rainfall variability for Australia. Although rainfall records for some months are not available from the Bureau of Meteorology from the Innamincka station especially after 2017, records are available for Moomba (66 km south-west of Innamincka) (Appendix V). In 2010 the area experienced extreme rainfall in terms of scale and intensity, resulting in closure of several roads during 2010-2011. Since the 2017 survey, there were good rains in 2016 with a total of 310 mm spread over several months[7]. In the preceding 12 months before the 2022 survey, there was patchy rain recorded at Innamincka – of note, 35 mm in November, 56 mm in March and 28 mm in April which could have resulted in the new plant growth noted for some of the transect surveys in this report.

Interestingly, there had been flooding of the Cooper Creek in the months before the 2022 survey due to heavy rains much further upstream earlier that year. Some roads around Innamincka were still closed at the survey time. However, this did not affect the habitat beyond the flood-line resulting in what can be called a ‘dry flood’.

The FOIR surveys provide data for monitoring changes in populations of terrestrial birds, mammals and vegetation as the weather conditions change between ‘normal’, dry and ecological boom. They also enable assessment of the impacts of other environmental changes such as mining, road-making and grazing.

C. APPROACH

Surveys were conducted along the Cordillo Downs Road within the Innamincka Regional Reserve, following as closely as possible the transects and methodology of the baseline surveys conducted in 2017. There were 8 census stops, starting from near the northern boundary of the Reserve and finishing ~60 km south, near Policeman’s Tank. Census stops were 10 km apart except for census stop 5 which was ~5 km from adjacent census stops to sample the Red Mulga habitat at Dripie Creek.

Landscape conditions did not require modification of census stop locations or routes for the baseline 2017 survey. Surveys at each census stop comprised transects along two 500 m-sided quadrants, one on each side of the track.

D. OBJECTIVES

1. To collect data systematically for bird, mammal and plant species, at a series of survey transects spanning ~60 km in total along the Cordillo Downs Road within the Innamincka Regional Reserve.
2. To relate species occurrence to short-term climatic and environmental variables.
3. To compare the survey data with that collected for the baseline Cordillo Downs Road survey conducted in 2017, assessing the impacts of longer-term changes in climate and environment on populations and species.
4. To use a bird survey technique equivalent to a ‘fixed-route’ survey as specified for the Birdlife Australia Atlas project.
5. To use these data to facilitate further monitoring of the change in flora and fauna population diversity and abundance as the conditions change to drier or wetter or due to other environmental impacts such as mining, grazing and road-making.

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[7] Bureau of Meteorology

E. PROGRAMME OF RESEARCH

Surveys were conducted between 29 July and 3 August 2022. The original survey was undertaken between 27 and 29 July 2017.

Team members setting out along a transect line at one of the census stops.

METHODS

1. Survey overview and terminology

The tracks were surveyed using the method used for the baseline survey in 2017 and described below, travelling an average of 20-30 km per day along the track, with census stops at approximately every 10 km of track length, except for Census Stop CR05 which was 5 km from adjacent census stops. The survey method is adapted from methodology used by Rob Clemens and Richard Fuller (School of Biological Sciences, University of Queensland) for similar surveys in outback SA. The survey technique is equivalent to a 'fixed-route' survey as specified for the Birdlife Australia Atlas project.

Key terminology (see also diagram in Fig. 1 below):

A **census stop** is one of the points placed at intervals along the road. The census stop forms a central point for conducting surveys in the surrounding habitat. The locations of all census stops are provided as GPS waypoints. If the exact location of the waypoint proves to be inaccessible, then the point is established along the road closest to the waypoint location.

A **corner point** is one of the corner points of a survey square.

A **transect** is one of the sides of a survey square.

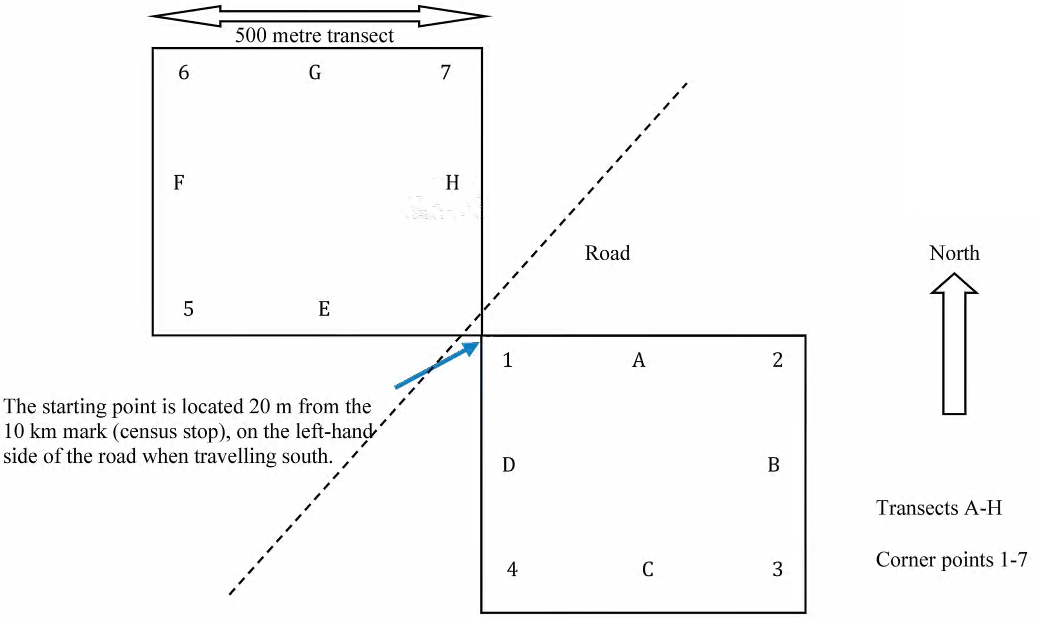

500 metre transect
6
G
7
F
H
5
E
Road
North
1
A
2
The starting point is located 20 m from the 10 km mark (census stop), on the left-hand side of the road when travelling south.
D
B
Transects A-H
Corner points 1-7
4
C
3

Fig. 1. Diagram of survey transect squares for each census stop

2. A typical day

A typical day commences at first light, travelling to the first census stop, surveying until around 11am-noon, when bird activity begins to decline noticeably. After a break during the heat of the day, surveys continue late in the afternoon when bird activity has increased again. Key equipment items for the surveys are listed in Appendix VII.

3. Communication

The team maintains contact using vehicle and hand-held UHF radios.

4. Briefing session

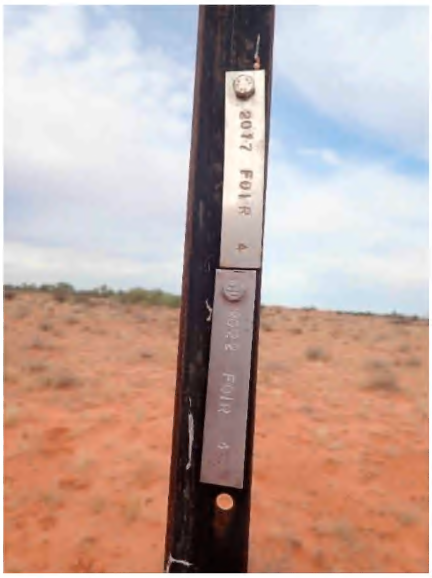
Before commencing surveys, leaders should brief the group on GPS technique for the survey and how to complete the survey sheets to ensure consistent data collection. The GPS co-ordinate system used is UTM and members must be familiar with how to select this on their GPS. A practice field session on using the GPS to complete a square is recommended. Two alternative methods for using the GPS to navigate a survey square are given in Appendix VI.

5. Survey work at each census stop

The following protocol was adopted for the baseline surveys and is being followed as closely as possible in future repeat surveys. If there are sufficient members in the group, half the group will take the east survey and the other half the west survey at each census stop.

In 2022 there was a smaller group than in 2017 which meant, for safety reasons, we worked as a single team. This doubled the time required for each census stop. During the mornings we repeated those census stops that had been surveyed in the morning during the original survey. Census stops originally surveyed in the afternoon were repeated in the afternoon across two days, transects A-D done on day 1 and E-H on day 2.

Upon arriving at a census stop, park the vehicle safely and place a hazard indicator (e.g. witch's hat) behind the cars if deemed necessary. Walk off the road 20 m from the census stop, left of the road when travelling south. Mark this starting location in the GPS (see diagram above, Fig. 1). Erect star dropper and attach metal tag with identifying detail e.g. 2017 FOIR 4 (see photos below). This is corner point 1 in Fig. 1. For repeat surveys, relocate the star dropper that was put in place during the original survey. Attach an additional metal identifier tag for the current survey.



(i) Write the co-ordinates onto the survey sheet to ensure they are not lost and note the weather details. Note down the dominant habitat type in the area surrounding the starting point (corner point 1). Choose from gibber, grassland, dunes, shrubland, lignum, woodland, wetland. Record dominant species in the vegetation if known. Take a photo of the survey sheet and then take representative photographs of the habitat at the starting point, one towards the centre of the eastern transect square and one towards the centre of the western transect square. When walking around each transect square in a clockwise direction (as was done for this survey), representative habitat photos are also taken at each corner, first towards the right (into the square) and then the left (outside the square).

(ii) Using a GPS to guide you, walk east for 500 m, conducting a line transect survey as you go (see methods below under 6. Line Transect method and Appendix VI - Using a GPS to navigate transect squares). As each transect line follows grid north/south or east/west, maintaining a constant grid northing or easting as appropriate allows the navigator to stay on the transect line. If your route must deviate around obstacles etc., return to the transect once the obstacle has been passed.

(iii) At 500 m from the starting point, i.e. at corner point 2, write the co-ordinates onto the survey sheet, note the time, and take a photo of the survey sheet and then of the habitat towards the centre and outside of the transect square as before. Continue in this fashion following the scheme in the diagram until 8 line transects have been completed. For repeat surveys, if copies of the original corner photos are available, use landmarks in these photos to help line up the repeat photos.

(iv) Aim to complete all the survey work for each census stop within 1.5-2 hours if working as two teams.

6. Line Transect method

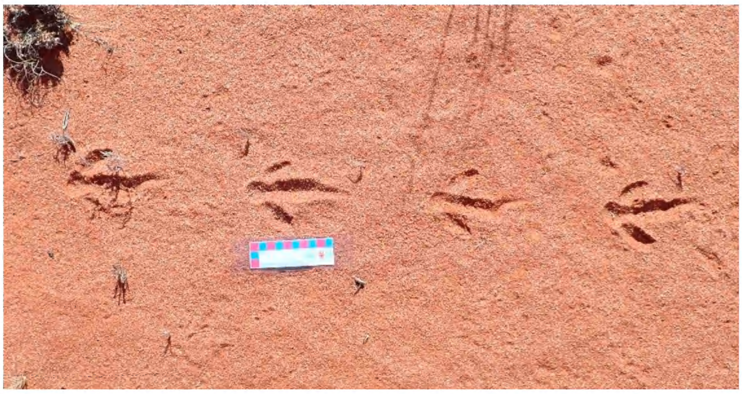
(i) Walk slowly along the transect line, looking and listening for birds. Pay careful attention for birds that are flushed from ground cover as you approach. For each individual or group of birds seen, note down (a) the species including age and sex if determined, (b) the number of birds in the group, (c) whether you heard and/or saw the birds, and (d) any evidence of breeding or feeding activity. Use a separate survey sheet for each 500 m transect. Avoid double counting on adjacent transects.

(ii) If you need to stop to check birds do so but try to keep a roughly even averaged slow walking pace throughout the transect.

(iii) There is no maximum distance for recording birds – every bird detected should be noted.

(iv) Note down any change in the dominant habitat type through which the transect passes (write across the line in the data collection columns). Record dominant species in the vegetation if known. Take representative photographs of the habitat. Ensure there is a photo of the survey sheet prior to the habitat photo so it is always clear which transect the photo belongs to.

(v) Note (write across the line in the data collection columns) and photograph any tracks or other traces and sightings of mammals/reptiles/birds. A photograph of tracks showing the gait of the animal/bird (i.e. set of prints) together with a ruler or measuring card (see photo) is useful for identification. A GPS reading for any significant sightings should be recorded.



Photograph of tracks with ruler

(vi) Record any threats or impacting factors noted e.g. soil erosion, weeds e.g. Buffel Grass (*Cenchrus ciliaris),* Mimosa Bush *(Vachellia farnesiana,* previously *Acacia farnesiana*), feral animals, mining, road-making, grazing, fire, water/drainage disturbance, strong wind.

7. Incidental surveys while driving between census stops

(i) When driving between census stops, sightings such as a particularly large group of birds, something very rare, or anything in the environment relevant to the aims of the study is recorded. These incidental survey records include a GPS reading followed by a 5 minute point count. The reason for the survey is noted e.g. "Cinnamon Quail-thrush crossed the road" and the surveys entered as an incidental survey in the Birdlife Australia Atlas database (Birdata).

(ii) Any wetlands that are visible from the road are surveyed with a count of any waterbirds present (2 ha/20 min, 500 m radius or 5 min incidental survey as appropriate). The GPS location is recorded and the wetland photographed.

(iii) A count of all mammals (feral and domestic) is recorded.

(iv) Make a note of any items left on or near the road such as tyres, garbage or equipment and record any threats (as described above, 6 (vi)).

RESULTS AND DISCUSSION

As for the baseline survey, 8 census stops were surveyed along the Cordillo Downs Road within the Innamincka Regional Reserve, following the transect routes for the 2017 survey. In most cases, time-of-day was closely matched with the original surveys. The exact location of the census stops and the co-ordinates for the survey points for the 2022 survey are given in Appendix I.

In 2021, rainfall was near average as shown by local figures for Innamincka Station (the closest weather station to the survey area) (Appendix V), while the first half of 2022 was trending above average. Rainfall records for Innamincka Station are incomplete for some months in years prior to 2021 and there was only one monthly record for 2019. Rainfall records from Moomba, 110 km to 160 km from the census stops of this survey, were the closest alternative records available and showed above average rainfall for the years 2020, 2021 and start of 2022 preceding the repeat survey. A comparison of annual rainfall decile ranks for the region (Fig. 8) shows similar trends. There had been flooding in Cooper Creek prior to the survey which had overflowed into Strzelecki Creek. This was caused by rainfall in the upper catchment of Cooper Creek rather than local rainfall, so impacts were restricted to the immediate channels and flood plains of the main rivers. The Cordillo Road was still closed at the Innamincka causeway until a few days prior to the survey.

A. BIRD SURVEY DATA

2022 Report and Comparison with 2017 Survey

Bird surveys were conducted over six days between 29 July and 3 August 2022. In 2017 the surveys were carried out from 27 – 29 July. Surveying was generally carried out before 1 pm or after 3pm when conditions were cooler and winds generally not so strong. Details of the 2022 bird survey data are given in Table 1 and Appendix II, and comparisons with the 2017 survey data are given in Tables 2 and 3 and Figs. 2-4. When conducting repeat surveys as far as possible we matched the time of day to that of the original surveys. In the case of the afternoon surveys this meant conducting them over two days.

In Table 1 unidentified corvids were not counted as an additional species as Little Crow and Australian Raven were recorded, however their numbers are included in the total number of birds.

Overall, the number of bird species recorded across the entire survey was similar to 2017, 42 versus 40, however some species were recorded in 2017 but not in 2022 and vice-versa (Table 3). The total number of individual birds recorded was almost four times higher than was recorded in 2017 (3327 vs 891) and the density of birds recorded over all transects rose from 27.84 to 103.97 per km of transect.

While the number of species recorded was similar between the two surveys, 14 species recorded in 2017 were not recorded in 2022, while 16 additional species were recorded in 2022. Two of these additional species, Budgerigar and Diamond Dove were the second and third most numerous species in 2022 (Fig. 4). Only one of the top species, Spiny-cheeked Honeyeater was recorded in 2017 but not in 2022. Across the two surveys 56 bird species were recorded in total.

Site CR07 was the only site where both fewer species and fewer birds were recorded in 2022 than in 2017 (Figs. 2 and 3). Here there was 26% decline in the number of species with a 5% decline in the number of individuals. Apart from CR01 where there was a small decrease in number of species but a large increase in individuals, all other sites had an increase in both number of species and number of individuals.

During the 2022 survey there were five abundant species where more than 100 individuals were recorded (Fig. 4). These were Zebra Finch, 1225 (425 in 2017), Budgerigar, 961 (not recorded in 2017), Diamond Dove 328 (not recorded in 2017), Little Corella, 232 (44 in 2017) and Little Crow, 112 (12 in 2017). Except for the Little Crow all these species are granivorous. Other granivorous birds were present in lower numbers, but most still showed population increase since the 2017 survey. Galahs showed a big increase across this time. Exceptions to this general increase of granivorous birds were the three parrot species that are less common in this area. Bourke's Parrot showed a small decline although they were seen at several sites between census stops. Greater Bluebonnet and Red-rumped Parrot were recorded in low numbers during the 2017 survey but not recorded in 2022.

Declines in number between the two surveys were notable amongst the honeyeaters where only Black Honeyeater and Crimson Chat (largely insectivorous) showed an increase in numbers. White-plumed and Spiny-cheeked Honeyeater and Orange Chat were recorded in 2017 but not recorded in 2022.

Raptor numbers were generally stable. Of the six raptor species, only Brown Falcon showed a moderate decline. There was a large increase in numbers of Nankeen Kestrel, probably because of a relative abundance of their insect prey. Large numbers of Spur-throated Locust, *Austracris guttulosa,* were recorded on several transects and would have provided food for the smaller raptors, particularly Nankeen Kestrels.

Insectivores and generalist numbers were, in most cases, either stable between the surveys or showed small declines. The largest decline in this group was for the Black-faced Woodswallow whose numbers declined by around 30%. The largest increase was for the Crimson Chat whose numbers were 15 times greater in 2022 than in 2017.

Emu was only recorded in 2017, but in 2022 Emu tracks were recorded at CR02 (old), CR03 (fresh) and CR07. This species is present in low numbers across the area and is highly mobile. The chances of finding these birds at a census stop is low given the open nature of the country which allows them to see humans from a considerable distance and move from the area.

An unusual sighting in 2022 was the Australian Pelican. The Australian Pelican was a single bird seen flying overhead during the survey so was not using any of the habitat being surveyed.

Census Stop 4 included the catchment area for a large stock-watering tank with the main body of the tank being on transect D of the census stop. The tank contained water at the time of the survey. This was the only surface water encountered while surveying any of the census stops. The Black-fronted and Red-kneed Dotterels were recorded here. This was also where we recorded the greatest number of Zebra Finches for the survey as flocks were coming it to the water. Our count of Zebra Finches probably under-estimates the actual number as there was continual activity with groups ranging from 10 to 100+ coming and going from the water.

The area where this survey was undertaken is heavily reliant on local rainfall. The above average rainfall over the previous two years and first half of 2022 prior to the survey meant that there had been reasonable growth of the native grasses and ephemeral herbs which in many cases had since died off. This burst of plant activity had produced an abundance of seeds which were now providing food for the granivorous species. At the same time, the die-off of ephemeral plants had probably reduced the resources available for invertebrates with flow-on effects for the insectivorous birds.

Seasonal conditions also affected the honeyeaters. Census stop 1 at the northern end of the Cordillo Rd is in habitat with scattered Bloodwoods, *Corymbia terminalis*, and Corkbark, *Hakea eyreana*, in addition to the usual Eremophilas, pea flowers and wattles. In 2017 these small trees were flowering at the time of the survey whereas in 2022 the season appeared to be slightly later with the first of the bloodwoods just starting to flower. The later flowering probably accounted for the reduced number of honeyeaters in this habitat. Black Honeyeaters that showed an increase in numbers were concentrated at Census Stop 3 where there were flowering Eremophilas in the dune swales.

Table 1: Summary of counts by census stop for each bird species along the Cordillo Downs Road – 2022 survey

Species	No. of census stops where present	Total count	Min. count /stop when present	Max. count /stop when present	Average /stop when present	Average for all 8 stops	Birds per km of transect
Australian Pelican*	1	1	1	1	1.00	0.13	0.03
Stubble Quail	2	2	1	1	1.00	0.25	0.06
Wedge-tailed Eagle	1	1	1	1	1.00	0.13	0.03
Whistling Kite	1	1	1	1	1.00	0.13	0.03
Black Kite	3	3	1	1	1.00	0.38	0.09
Australian Hobby	1	1	1	1	1.00	0.13	0.03
Brown Falcon	6	14	1	4	2.33	1.75	0.44
Nankeen Kestrel	6	13	1	3	2.17	1.63	0.41
Black-fronted Dotterel	1	1	1	1	1.00	0.13	0.03
Red-kneed Dotterel	1	1	1	1	1.00	0.13	0.03
Little Buttonquail	4	16	1	8	4.00	2.00	0.50
Crested Pigeon	3	21	4	10	7.00	2.63	0.66
Diamond Dove	3	328	17	214	109.33	41.00	10.25
Galah	5	93	12	49	18.60	11.63	2.91
Little Corella	4	232	2	150	58.00	29.00	7.25
Cockatiel	4	27	4	12	6.75	3.38	0.84
Bourke’s Parrot	3	11	1	8	3.67	1.38	0.34
Budgerigar	8	961	1	411	120.13	120.13	30.03
Australian Owlet-nightjar	1	1	1	1	1.00	0.13	0.03
Red-backed Kingfisher	2	3	1	2	1.50	0.38	0.09
Purple-backed fairywren	1	2	2	2	2.00	0.25	0.06
White-winged Fairy-wren	6	32	2	9	5.33	4.00	1.00
Chestnut-rumped Thornbill	2	3	1	2	1.50	0.38	0.09
Banded Whiteface	1	2	2	2	2.00	0.25	0.06
Redthroat	1	1	1	1	1.00	0.13	0.03
Black Honeyeater	4	20	1	13	5.00	2.50	0.63
Singing Honeyeater	4	17	1	7	4.25	2.13	0.53
Pied Honeyeater	1	2	2	2	2.00	0.25	0.06
Yellow-throated Miner	2	7	1	6	3.50	0.88	0.22
Crimson Chat	3	61	4	45	20.37	7.63	1.91
Red-capped Robin	2	6	3	3	3.00	0.75	0.19
Chirruping Wedgebill	2	4	2	2	2.00	0.50	0.13
Cinnamon Quail-thrush	1	2	2	2	2.00	0.25	0.06
Grey Fantail	1	1	1	1	1.00	0.13	0.03
Willie Wagtail	5	19	1	10	3.80	2.38	0.59
Black-faced Cuckooshrike	1	1	1	1	1.00	0.13	0.03
Black-faced Woodswallow	6	38	2	18	6.33	4.75	1.19
Australian Raven	3	10	3	4	3.33	1.25	0.31

Little Crow	6	112	6	46	18.67	14.00	3.50
Crow/Raven sp.	6	28	2	8	4.67	3.25	0.88
White-backed Swallow	1	2	2	2	2.00	0.25	0.06
Tree Martin	1	1	1	1	1.00	0.13	0.03
Zebra Finch	8	1225	21	574	153.13	153.13	38.28
Total Species	**42**						
Total Individuals		**3327**					**103.97**

*** Seen flying overhead**

Table 2: Comparison of numbers of birds observed for each census stop for baseline (2017) and repeat (2022) surveys

Census Stop	**2017**		**2022**		**% change from baseline ***	
	No. of species**	**No. of individuals**	**No. of species****	**No. of individuals**	**No. of species****	**No. of individuals**
CR01	17	224	16	719	(6%)	221%
CR02	6	17	9	137	50%	706%
CR03	8	104	11	244	37%	115%
CR04	13	113	25	830	92%	734%
CR05	11	65	16	509	45%	683%
CR06	11	79	12	361	9%	357%
CR07	23	128	17	121	(26%)	(5%)
CR08	16	161	17	406	6%	152%
Total	**40**	**891**	**42**	**3327**	**5%**	**373%**
Average	**13.25**	**111.4**	**14.63**	**415.88**	**10%**	**224%**

* Decreases in parentheses. ** Excludes unidentified corvids.

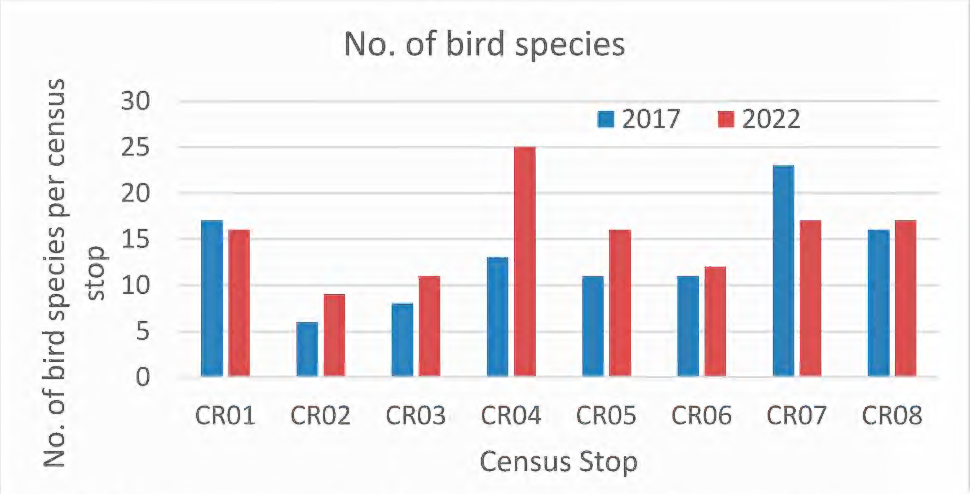


Fig. 2 Comparison of no. of bird species at each census stop

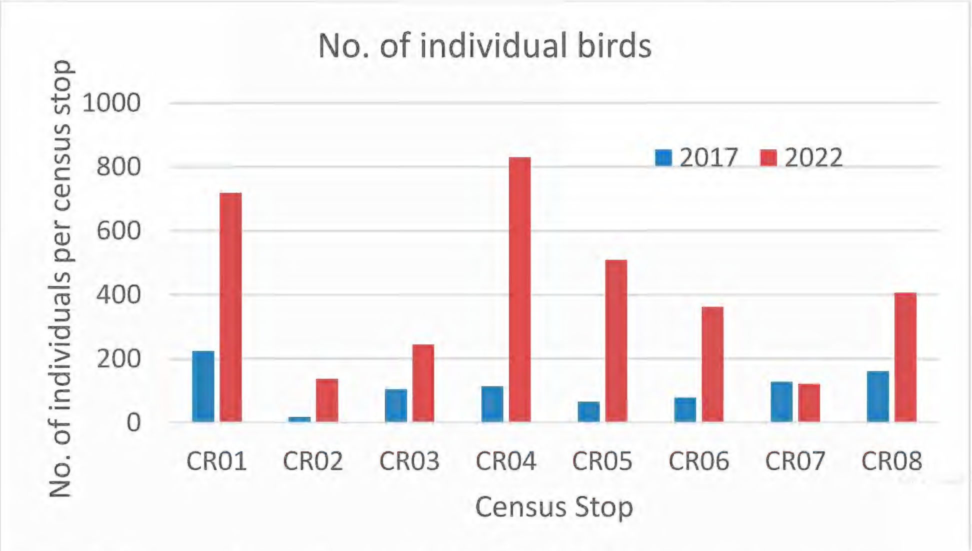


Fig. 3 Comparison of no. of individual birds at each census stop

Table 3: Comparison of counts for each bird species for baseline (2017) and repeat (2022) surveys

Name	**2017**			**2022**			
	No. of census stops where present	**Count**	**Birds per km of transect**	**No. of census stops where present**	**Count**	**Birds per km of transect**	**Change between surveys Birds/km**
Emu	1	2	0.06	-	-	-	-0.06
Australian Pelican*	-	-	-	1	1	0.03	0.03
Stubble Quail	1	2	0.06	2	2	0.06	0.00
Wedge-tailed Eagle	1	1	0.03	1	1	0.03	0.00
Whistling Kite	-	-	-	1	1	0.03	0.03
Black Kite	1	3	0.09	3	3	0.09	0.00
Australian Hobby	-	-	-	1	1	0.03	0.03
Brown Falcon	6	11	0.34	6	14	0.44	0.10
Nankeen Kestrel	4	7	0.22	6	13	0.41	0.19
Black-fronted Dotterel	-	-	-	1	1	0.03	0.03
Red-kneed Dotterel	-	-	-	1	1	0.03	0.03
Little Buttonquail	-	-	-	4	16	0.50	0.50
Crested Pigeon	4	13	0.41	3	21	0.66	0.25
Diamond Dove	-	-	-	3	328	10.25	10.25
Galah	2	13	0.41	5	93	2.91	2.50
Little Corella	3	44	1.38	4	232	7.25	5.88
Cockatiel	-	-	-	4	27	0.84	0.84
Bourke's Parrot	1	13	0.41	3	11	0.34	-0.06
Red-rumped parrot	1	2	0.06	-	-	-	-0.06
Greater Bluebonnet	3	9	0.28	-	-	-	-0.28
Budgerigar	-	-	-	8	961	30.03	30.03
Horsfield's Bronze-cuckoo	1	2	0.06	-	-	-	-0.06

Australian Owlet-nightjar	-	-	-	1	1	0.03	0.03
Red-backed Kingfisher	-	-	-	2	3	0.09	0.09
Purple-backed fairywren	-	-	-	1	2	0.06	0.06
White-winged Fairy-wren	7	38	1.19	6	32	1.00	-0.19
Chestnut-rumped Thornbill	1	1	0.03	2	3	0.09	0.06
Banded Whiteface	1	5	0.16	1	2	0.06	-0.09
Red-browed Pardalote	1	3	0.09	-	-	-	-0.09
Redthroat	-	-	-	1	1	0.03	0.03
Black Honeyeater	1	4	0.13	4	20	0.63	0.50
White-plumed Honeyeater	1	5	0.16	-	-	-	-0.16
Singing Honeyeater	8	43	1.34	4	17	0.53	-0.81
Pied Honeyeater	1	3	0.09	1	2	0.06	-0.03
Spiny-cheeked Honeyeater	5	21	0.66	-	-	-	-0.66
Yellow-throated Miner	4	63	1.97	2	7	0.22	-1.75
Crimson Chat	1	4	0.13	3	61	1.91	1.78
Orange Chat	1	2	0.06	-	-	-	-0.06
Red-capped Robin	3	8	0.25	2	6	0.19	-0.06
Chirruping Wedgebill	4	12	0.38	2	4	0.13	-0.25
Cinnamon Quail-thrush	2	4	0.13	1	2	0.06	-0.06
Chestnut-crowned Babbler	2	9	0.28	-	-	-	-0.28
Grey Fantail	-	-	-	1	1	0.03	0.03
Willie Wagtail	3	9	0.28	5	19	0.59	0.31
Rufous Whistler	1	2	0.06	-	-	-	-0.06
White-winged Triller	1	1	0.03	-	-	-	-0.03
Black-faced Cuckooshrike	-	-	-	1	1	0.03	0.03
Black-faced Woodswallow	7	56	1.75	6	38	1.19	-0.56
Grey Butcherbird	1	1	0.03	-	-	-	-0.03
Australian Magpie	2	11	0.34	-	-	-	-0.34
Australian Raven	4	11	0.34	3	10	3.13	2.78
Little Crow	5	12	0.38	6	112	3.50	3.13
Crow/Raven sp.	3	11	0.34	6	28	0.88	0.53
White-backed Swallow	1	3	0.09	1	2	0.06	-0.03
Fairy Martin	1	2	0.06	-	-	-	-0.06
Tree Martin	-	-	-	1	1	0.03	0.03
Zebra Finch	7	425	13.28	8	1225	38.28	25.00
Total Individuals		**891**	**27.84**		**3327**	**103.97**	**76.13**

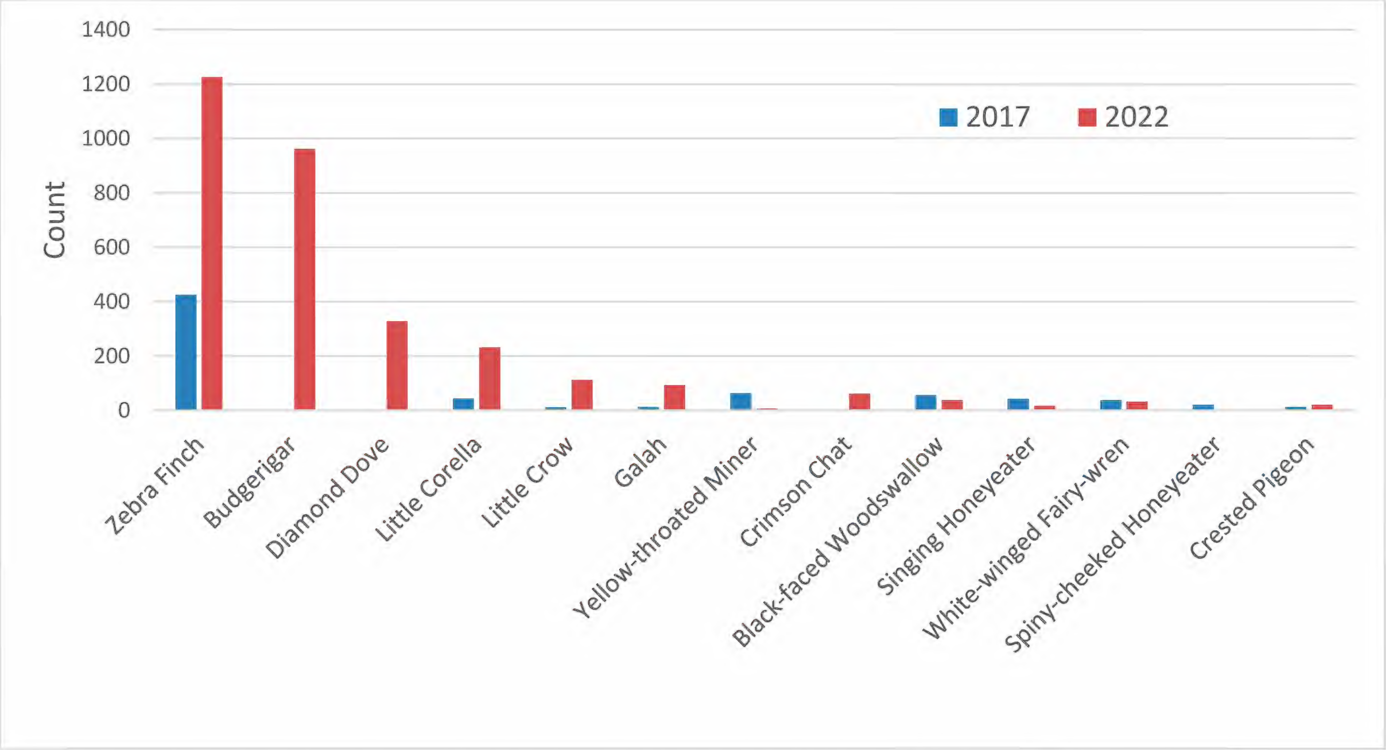


Fig. 4 Comparison of counts for the 9 top-listed birds for both the 2017 and 2022 surveys

Birds recorded outside of normal surveys

In addition to those birds recorded on the surveys there were some notable sightings recorded at other times during the survey period. Several of these sightings were recorded near our campsite which was within the boundary of Census Stop 5.

Inland Dotterel. A flock of at least 40 birds was observed on gibber plain approximately half-way between census stops 4 and 5.

Australian Bustard. A pair of Australian Bustard were observed on the plains a few kilometres north of Patchawarra Ck. Bustard tracks were recorded on transects for CR03 and CR06.

Collared Sparrowhawk. This species was recorded in the Coolibah along Montkeleary Creek.

Brown Falcon. A pair had an active nest at Dripie Ck. Their behaviour indicated that they were probably sitting on eggs.

Barking Owl. This species was recorded in the Coolibah along Montkeleary Creek.

Spiny-cheeked Honeyeater & White-plumed Honeyeater. Both these species were present along Montkeleary Creek. Neither were recorded at the census stops but were still present in an area that is probably better watered although no surface water was found at the time.

Breeding

There were few records of breeding during or around the survey. The most significant record was the Brown Falcons at Dripie Ck. Zebra Finches were nesting in low numbers at Dripie Creek/CR05. Inactive Zebra Finch nests were seen at all census stops.

B. HABITATS

The area surveyed is in the Marqualpie Land System of north-eastern South Australia. The region is characterised by jumbled crescent-shaped sand dunes interspersed with clay pans which flood from local rains[8].

Census stops CR01 to CR04 and CR06 were all within the Marqualpie Land System where the habitat was sand dunes interspersed with low sand plains and clay pans. The largest dunes encountered on the surveys were at CR01. There were more trees at CR01 where there were scattered Bloodwoods, *Corymbia terminalis,* in the dune swales. At the other census stops in this group, woody vegetation was mainly *Hakea spp*., *Acacia spp*., *Eremophila spp*., and *Senna artemisioides*. Ephemeral shrubs were mainly confined to the red dunes. The sand plains generally had a good cover of hummock grasses interspersed with ephemeral herbs. At CR03 there were extensive areas of *Triodia basedowii* on low dunes. This species was generally confined to the dunes rather than the sand plains.

Census stop CR05 was at Dripie Ck on the edge of the Marqualpie System. Along the creek line vegetation was dominated by *Acacia cyperophylla*, Red Mulga, with occasional *Eucalyptus coolabah*. There was an open understory of low shrubs, salt bushes and grasses including the invasive Buffel Grass, *Cenchrus ciliarus*. Away from the creek the sand plains had a cover of open tussock grassland, mainly *Aristida spp*.

Census stops CR07 and CR08 were on the eastern edge of the Marqualpie System. At CR07, Candradecka Creek supported typical creek-line vegetation of Red Mulga with a shrubby understory. Once away from the creek there was either sand plain grassland or gibber plain with low ephemeral salt bushes. CR08 was on a sand plain with drainage lines leading to the now enlarged Policeman's Dam. Close to the drainage lines there was a good cover of *Acacia spp*., *Eremophila spp*., and *Atalaya hemiglauca*, Whitewood. The eastern part of this CR08 extended onto gibber plain with low saltbush. The western side crossed sand plain with tussock grassland.

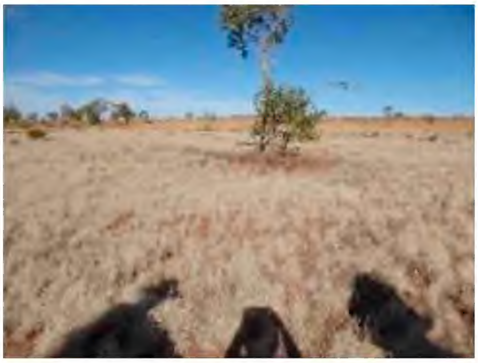
These habitats have been described in more detail in the report from our 2017 Survey.[9]

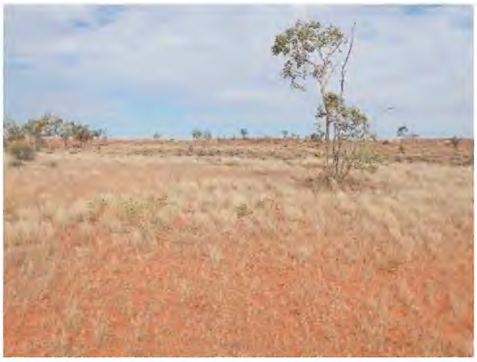
Comparison with 2017 survey

Changes can be seen clearly in the comparative photos of the vegetation cover taken at the same corner points in 2017 and 2022 (Appendix III), examples of which are shown below.

2017 **2022**

Census Stop CR01 Corner Point 4 – showing loss of ground cover grasses leaving bare ground and thinning of the tree canopy.





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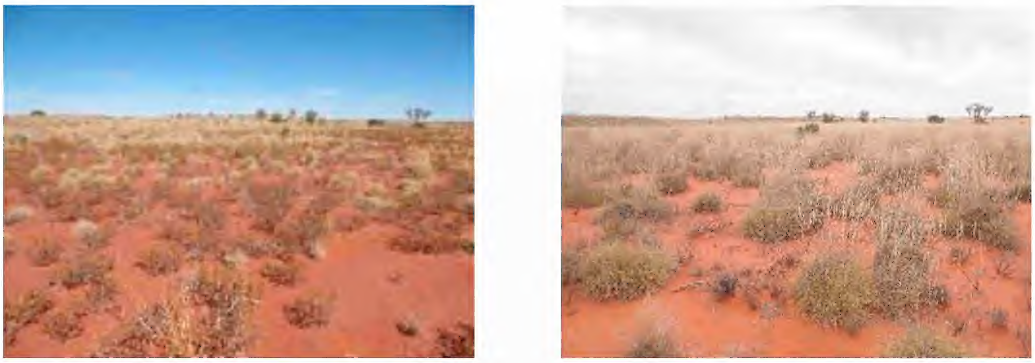
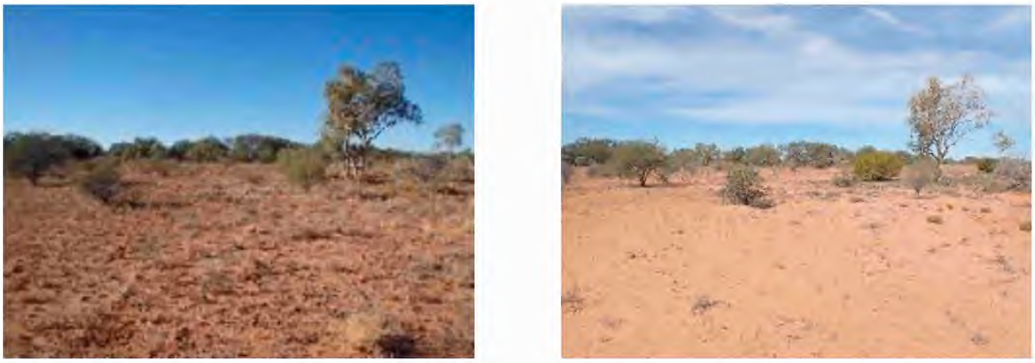
[8] N. Neagle, D. Armstrong and D. Wallace-Ward, 2010. A Biological Survey of the Marqualpie Land System, South Australia 2008. Science Resource Centre Client Services Directorate Department of Environment and Natural Resources, South Australia.

[9] Cordillo Downs Road Birds, Mammals & Vegetation Survey 2017. Friends of the Innamincka Reserves 2018.

Census Stop CR02 Corner Point 4 – showing loss of small shrubs and increase in size of the Spinifex hummocks. Percentage of ground cover is fairly constant across the two surveys.



Census Stop CR07 Corner Point 6 – showing loss of ground cover and major thinning of the canopy of trees and shrubs. forbs



The cover photo of this document also illustrates how there has been a loss of woody vegetation at CR06, transect D where many of the Mulga, *Acacia aneura*, have died since the 2017 survey.

A comparison of the number of bird species by vegetation type at each census stop is shown in Table 4 below. The number of species recorded at each census stop was similar to that recorded in 2017 however there were some changes in the species recorded at each stop. At most census stops there was a small to moderate increase in the number of species recorded.

The most notable change was the big increase in the number of species recorded at census stop 4. This is attributed to the presence of water at the New Year Tank just outside the quadrat along transect D. This was one location where the woody vegetation remained relatively healthy.

At census stop CR07 there was around 25% decline in the number of species although this site still ranked second equal for the number of species. This site has a wide strip of Acacia woodland either side of Candradecka Creek however the woodland is not in good condition with many dead trees, mainly Red Mulga, *Acacia cyperophylla*.

The increases at other sites may be attributed to the increase in seed eating birds such as Diamond Dove, Budgerigar and Little Buttonquail in particular that were not present during the 2017 survey.

Table 4: Bird species by vegetation type at census stops

Census stop	Topography	Vegetation types		No. of bird species	
				2017	2022
CR01	Dunes and sand plain	Dunes: *Triodia*, *Crotalaria*, *Grevillea*, shrubland 30%	Sand plain: *Corymbia* woodland and grassland 70%	17	16
CR02	Undulating sand plain	*Triodia*/hummock grassland with open *Acacia* shrubland 100%		6	9
CR03	Undulating sand plain	Hummock grassland with *Acacia* shrubs and sparse Mulga woodland 100%		8	11
CR04	Undulating clay/sand plain with gibber rises. Nearby stock water tank.	Open shrubland with wire-grass understory 60%	Sparse grassland with *Senna* and low saltbushes 40%	13	25
CR05	Undulating clay/sand plain dissected by creek-lines	Open shrubland over grass/forbs understory 25%	Riparian Red Mulga with occasional Coolibah and River Redgums 75%	11	16
CR06	Undulating clay/sand plain	Grassland with sparse *Acacia* and *Hakea* 100%		11	12
CR07	Stony rises dissected by creek-lines	Riparian Red Mulga and Eucalypt creek-line 30%	Low shrubland dominated by Chenopods 70%	23	17
CR08	Floodplain with gibber slopes and sandy rises	Chenopod and *Eremophila* grassland with sparse woodland extending into gibber in some areas 100%		16	17

C. FLORA

Broadly there were five different floristic communities associated with the different landforms. These were described in more detail in the report of the 2017. The habitat types are:

1. Low open woodland in the dune swales.
2. Open mixed shrubs and hummock grasses on red dunes.
3. Hummock grasslands on the undulating sand plains.
4. Sparse shrublands and grasslands with some very sparse largely ephemeral herb fields that were usually associated with the clay plains and stony rises.
5. Riverine communities of Coolibah and Red Mulga associated with ephemeral water courses.

There was often overlap of these vegetation types, particularly where there was a change of topography or soil type. During the survey we photographed many of these plants, particularly those that were in flower. These photos are included in Appendix IV.

1. Low open woodland on the dunes and swales.

This plant community occurred at the northern end of survey (CR01) where there was open woodland dominated by Desert Bloodwood, *Corymbia terminalis*, in the swales between the dunes. There was a moderately dense cover of tussock grasses which had already seeded. There were also a few small trees of

Bumble Tree, *Capparis mitchellii,* and Straggly Corkbark, *Hakea eyreana,* in this area. Both the Bloodwoods and the Corkbark were at the start of their flowering season.

2. Open mixed shrubs and hummock grasses on red dunes.

On the dunes the vegetation consisted of a mixture of shrubs and hummock grasses with large areas of bare ground. The dominant grasses were Hard Spinifex, *Triodia basedowii* and, Sandhill Canegrass, *Zygochloa paradoxa*. There was a wide range of low shrubs on the dunes including Small-beard Fanflower, *Scaevola parvibarbata*, Rough Halgania, *Halgania cyanea*, *Newcastelia cephalantha*, several species of *Eremophila*, *Acacia*, and *Crotalaria* along with *Grevillea stenobotrya*. There was also a wide range of herbaceous plants, most prominent of which were the *Ptilotus spp*., *Calandrinia spp*. and *Swainsona spp*.

This community was mainly found at the northern census stops, particularly CR01 and CR02 although small areas occurred on the higher dunes at some of the other census stops. Many of the herbs and shrubs in this community were either flowering or had recently finished flowering.

3. Hummock grasslands on the undulating sand plains

The dominant grass in these areas was Hard Spinifex, *Triodia basedowii*, with a scattering of mainly low shrubs, mainly *Acacia sp., Senna artemisioides* and various *Eremophila sp*. The ground cover in these areas was generally more than 50%. There were relatively few birds but small skinks and dragon lizards were common and there were numerous small mammal tracks. This community was mainly found at census stop 3 with smaller areas at other census stops.

4. Sparse shrublands and grasslands with some very sparse largely ephemeral herb fields that were usually associated with the clay plains and stony rises

These areas generally had the poorest vegetation cover. The dominant vegetation was a mixture of *Chenopodiaceae* from several genera. In many cases these low ephemeral shrubs were dead. The only birds seen in these areas were Cinnamon Quail-thrush, Bourke's Parrot and Black-faced Woodswallow.
This community mainly occurs in the south of the survey area at the interface between the Marqualpie system and the stony rises to the east.

5. Riverine communities of Coolibah and Red Mulga associated with ephemeral water courses.

This is the riparian strip along the significant creek lines (Dripie & Candradecka Creeks). The dominant trees are Red Mulga, *Acacia cyperophylla,* that usually grow to 6-7m tall. There are also some Coolibah, *Eucalyptus coolabah*, and River Red Gum, *Eucalyptus camaldulensis*, mainly where there would be longer lasting pools of water following floods.

In these areas there is an understory of smaller *Acacia sp., Eremophila spp., Senna artemisioides*, and *Hakea sp*. Smaller shrubs of saltbushes, *Solanum spp.* and *Malvaceae* also occur along with grasses and herbs. Unfortunately, as mentioned elsewhere, these creek lines are also a hot spot for Buffel Grass.

This habitat tended to have a greater variety of birds than the other habitats encountered during the survey.

D. MAMMALS

1. Cattle

Cattle tracks were recorded at most of the eight census stops. At the northern census stops, tracks that were seen were usually quite old and spread out indicating a low level of use (CR03 and CR04).

At CR05 cattle tracks were present at several locations. There was also heavy grazing of Buffel Grass and erosion caused by cattle along the creek line to the west of the fence that ran in a north-south direction through the census stop. This area also had a greater density of weed species than other census stops.

At CR06 there were frequent tracks, usually well spread out and from what appeared to be a small group of animals. The well-defined cattle tracks did not appear to have had recent heavy use. Browsing of shrubs along the creek was also seen at CR07.

The greatest density of tracks was at CR04 and CR08 where they radiated out from the nearby water points (Leap Year Dam at CR04 and Policeman's Dam at CR08). Groups of cattle were seen at CR08, mainly in small groups with more than 60 animals seen in total. These were all in the area closest to the Policeman's Dam water point. There were many tracks and scats in this area.

Overall, this area (Marqualpie system) is probably more lightly grazed than the flood plains and grasslands closer to the Cooper Creek floodplain. This is likely due to fewer water points in this part of the reserve.

2. Feral horses/donkeys

No tracks or scats were recorded during the survey.

3. Rabbits

Very little evidence of rabbits was recorded during the survey. Old rabbit scats were noted at census stops CR03 and CR04. There were fresh rabbit scats at census stop CR07. No live rabbits were seen during the survey.

4. Dingo

The only evidence of dingos during the survey was some scats seen at Census Stop CR02, positioned within a ring of Triodia hummock grass. Dingos appeared to be in low numbers in the Innamincka region at the time of the 2022 survey with only occasional animals being seen or heard in the vicinity of camping areas along Cooper Creek.

5. Cat

Cats are cryptic animals, rarely observed. Numerous cat tracks were recorded at CR02 and at CR08. Fresh scats were recorded on CR07 and CR08 (Appendix IV).

6. Fox

No evidence of foxes was recorded during the surveys.

7. Camel

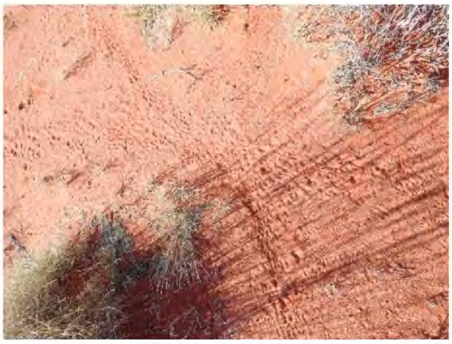
Camel tracks were seen at Census Stop CR01(recent) and CR02 (old). Camel scats were seen at CR01 and CR04. Two camels were seen about 5km north of census stop CR05.

8. Kangaroos

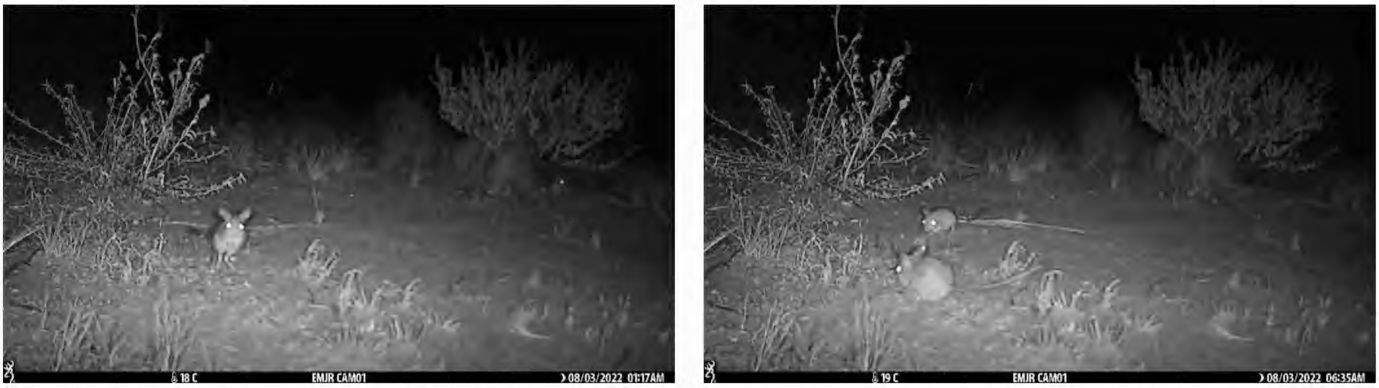
There was little evidence of kangaroos recorded during the survey. Kangaroo scats were recorded at one location at census stop CR05. No kangaroo tracks were noted.

9. Other mammals

Numerous small mammal tracks were seen, particularly in Triodia grassland at census stops CR02 and CR03. As the group planned to drive past CR03 on several occasions during the survey period we decided to deploy a trail camera looking over a clear area of sand between Triodia hummocks where there was a high density of tracks. The camera was set up using a portable step from our camp for support (photo). We did not use a bait station or lure of any kind but chose a site based on the high level of activity at the location as indicated by the tracks in the sand. This camera recorded many images of hopping mice, *Notomys sp.,* over a two-day period with up to four individuals in a single frame. While it is not possible to make a definitive identification from the images, based on geographic location, habitat type and requirements these are likely to be Spinifex Hopping Mice, *Notomys alexis*.



Hopping mouse trackways and burrow. The trail camera (right) was set up using a step from our camp overlooking these trackways.



Hopping mice, *Notomys sp*. in Triodia grassland at CR03

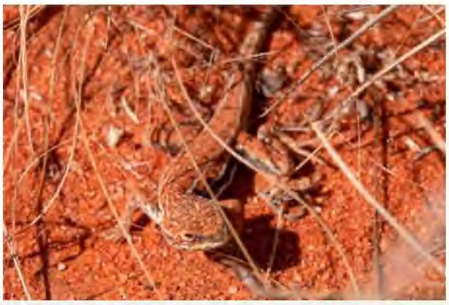
E. REPTILES AND AMPHIBIANS

A Central Bearded Dragon, *Pogona vitticeps* (photo below), was seen at Census Stop CR08 and another near CR01.

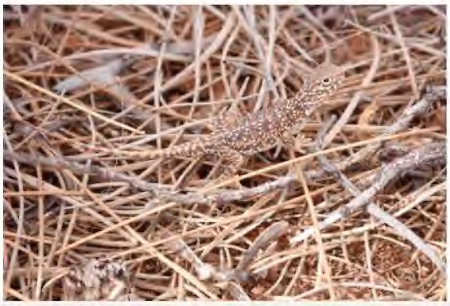
There were numerous small reptile tracks and holes seen across the dune areas throughout the survey. Several small dragon lizards were recorded (see photos below). Central Netted Dragon, *Ctenophorus nuchalis*, were seen and photographed at census stops CR03 and CR05. A Military Dragon, *Ctenophorus isolepis,* was also recorded at CR03. A few other small reptiles were seen, mainly dragons but including some skinks, however it was not possible to get photos that would allow them to be identified.

No snakes were recorded but there was a possible scat (see photo Appendix IV Census Stop CR1 transect H).

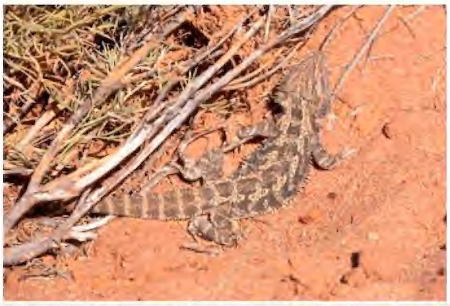
No amphibians were recorded.



Military Dragon, *Ctenophorus isolepis***.**



Central Netted Dragon, *Ctenophorus nuchalis.*



Central Bearded Dragon, *Pogona vitticeps.*

F. INVERTEBRATES

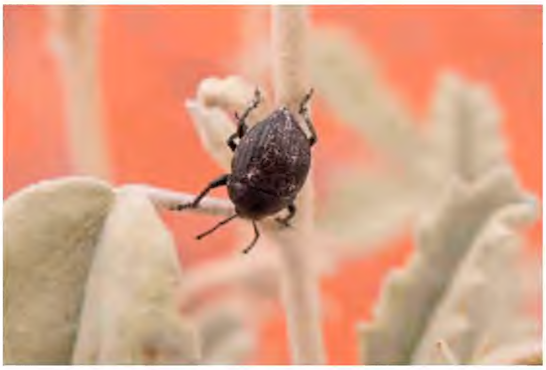
Apart from flies in areas where cattle were present, insects and other invertebrates were not particularly prominent during the survey.

Blistered Pyrgomorph, *Monistria pustulifera*

Spur-throated Locusts, *Austracris guttulosa,* were conspicuous amongst the tussock grasses and *Triodia*. The large and attractive Blistered Pyrgomorph, *Monistria pustulifera,* was also recorded in the Triodia grassland.

Three butterflies were recorded, Long-tailed Pea-blue, *Lampides boeticus,* Small Grass-yellow*, Eurema smilax*, and Caper White, *Belenois java,* were all moderately common. Caper Whites were found breeding on *Capparis mitchellii* not far outside the survey area.

There were numerous ants and ant nests seen during the course of the survey. Those that were photographed were from the genus *Iridiomyrmex.*



Hadrorhinus collaris

Two beetles have been identified to species level. The Transverse Ladybird, *Coccinella transversalis,* was relatively common on shrubs. An unusual mottled black weevil has been identified as *Hadrorhinus collaris*. It was found feeding on small shrubs of the *Malvaceae* family. This species appears to be seldom recorded as there are few records or photographs in the publicly available databases.

Several moths, a lacewing, *Trichoma gracilipenne,* and a small *Cliomantis sp.* were recorded at night at our campsite.

Along the creek lines where there was Red Mulga, Australian Golden Orbweavers, *Trichonephila edulis,* were common.

G. THREATS AND POTENTIAL IMPACTING FACTORS

1. Cattle grazing

At the time of the survey there were cattle grazing at the southern end of the survey area near Policeman's Dam. Grazing that is too intense destroys the vegetation and damages fragile soils. This represents a loss of habitat and food for both cattle and native species which can threaten the viability of grazing and the survival of native species. There were signs of cattle damage to the vegetation at census stops CR04 (Leap Year Tank), CR05 (Dripie Ck) and CR08 (Policeman's Dam). In addition to damage to native vegetation cattle may also be a vector for invasive weeds and modify the environment in ways that encourage weeds such as by soil disturbance and by selectively browsing native plants that would otherwise compete with the weeds.

2. Soil Erosion

Accelerated soil erosion is not a major problem in this part of the reserve although there are areas of severe erosion at some locations. Most erosion was either associated with water channels caused by run-off during heavy rain or was wind erosion where the friable surface layers had been stripped back to a hard sand/clay pan. Vehicle tracks including those no longer in use are also a source of erosion. This is particularly bad at CR08 where a former path of the Cordillo Rd has become an eroded creek line.

There was also erosion caused by cattle grazing and rubbing and pawing at an area of concentrated cattle use on Dripie Ck. Cattle break the organic crust on the fragile soils with their tracks. This exposes the soils to further erosion from both wind and water.

CR05: Cattle have pawed and rubbed into the sand bank.

3. Weeds

The most significant weed encountered on the survey was Buffel Grass *(Cenchrus ciliaris)* which was recorded at Census Stops CR01 (along the road and spreading out for up to 100m onto the dunes), CR02 (a single plant on transect 'B'), CR05 and CR07. Dripie Ck runs through CR05 and Candradecka Ck runs through CR07. Both creeks were dry at the time of the survey. In both cases there were significant amounts of Buffel Grass along the banks of the channels, sometimes spreading out onto flood plains on either side of the creeks. The Buffel Grass has spread both upstream and downstream from the road, or possibly downstream from initial points of establishment where tracks cross these creeks on the plateau to the east of our survey points. At CR01 Buffel Grass was spreading out from the road towards the dunes for up to 100m. At this site it appears to be spread by road maintenance activity which is moving seeds and plants along the road.

Buffel Grass lines the bank of Dripie Ck on CR05.

Bushes of Sweet Acacia, *Vachellia farnesiana,* were found at several locations, particularly at CR07 and CR08 where they were concentrated along the road and the creek lines.

The only other important weed encountered was *Datura leichhardtii* which was fairly common along Dripie Ck at CR05.

Sweet Acacia, *Vachellia farnesiana,* near the road at CR07.

Most of the other introduced plants that were encountered were minor weeds.

4. Feral animals

The density of feral animals in the area appeared to be low. Tracks and scats of camels and cats were recorded as noted above and shown in the photos in Appendix IV. Two camels were seen near CR05.

5. Mining, tourism and other human activity

This road is a popular tourist routes leading north from Innamincka to meet the Birdsville Development Rd in Queensland. This road provides access to several gas fields although most of these are south of our survey area and all are outside our survey area. This road also provides access to stock yards and outstations on Innamincka Station and Cordillo Downs station to the north. Tourist vehicles are restricted to the main routes, while mining and station works vehicles use both public roads and private side roads.

Some old unused vehicle tracks were encountered at several census stops. These were generally indistinct and not causing any issues.

Despite the high level of use, very little rubbish was recorded along the public roads during the survey. There were few signs of off-road driving with most informal tracks having been created many years previously.

6. Fire

Evidence of wildfire was recorded at CR02 where there were the burnt stumps of large shrubs present. At several places along the transects. This fire was not recent as most of the partly burnt wood had broken down and the vegetation largely recovered. Along transects on the western half of CR06 there were some remains of burnt Triodia. Again, the fires were not recent. There was a general absence of living Triodia hummocks and shrubs which have not recovered since the fire with tussock grasses being dominant. In some locations there were a few small Triodia hummocks (<30cm diameter) that were regenerating.

H. ARCHAEOLOGICAL SITES

The Innamincka area is of great aboriginal historical importance. On this survey, very few signs of past aboriginal use were recorded.

At census stop CR08 just north of Policeman's Dam a few stone flakes and a single spear point were seen exposed on clay pans.

Small numbers of scattered stone flakes were also found on CR02. No other artefacts were observed at any of the other census stops.

No European archaeological relics were found on this survey.

Stone spear point

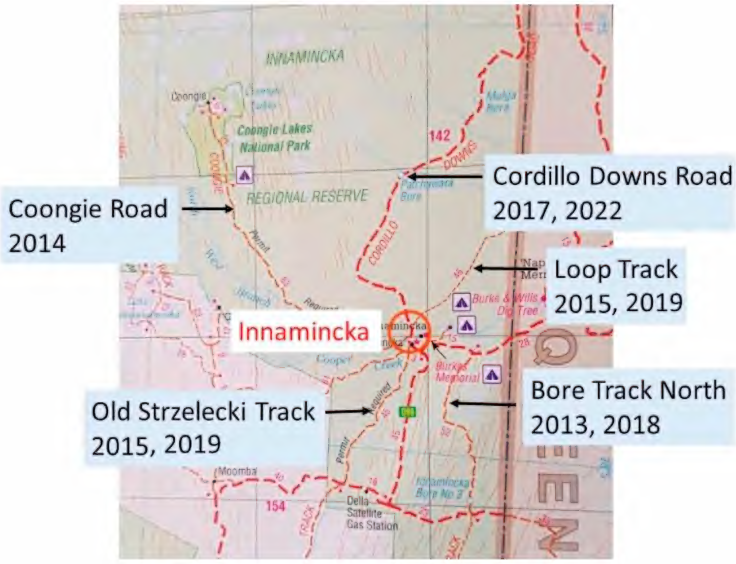
SUMMARY AND CONCLUSIONS

The Innamincka Regional Reserve encompasses a diversity of land systems, including large areas of the Cooper Creek System, one of the world's last unregulated arid freshwater systems and a key component of the Lake Eyre Basin. The Marqualpie Land System (jumbled dune field interspersed with small claypans and ephemeral lakes in the swales) where this survey was conducted is in the north-east corner of the reserve. The Merninie Land System (gibber slopes with occasional mesas) is to the south-east of our survey area with some of our census stops on the boundary between these two systems. The ephemeral creeks that cross the survey area flow into the terminal lakes of the Cooper Creek system (Coongie Lake and those to the north of Coongie)

The area falls within an under-protected bioregion of the National Reserve System. The landscape is also of profound spiritual and cultural significance to the traditional custodians of the land, the Yandruwandha and Yawarrawarrka people.

The Innamincka Regional Reserve, Malkumba-Coongie Lakes National Park and surrounding area is important for its outstanding ecological processes, its status as an unregulated natural water system, and its migratory birds, waterfowl and fish diversity. The Cooper and Strzelecki Creeks and their permanent and semi-permanent waterholes provide critical wildlife habitat during dry periods, enabling numerous species to persist in the region. The Innamincka Regional Reserve Management Plan (2018) notes that the reserve protects habitat for eighteen migratory bird species listed under bilateral migratory bird agreements, four threatened fauna species listed under the EPBC Act (Night parrot, Kowari, Dusky Hopping Mouse, Plains

Mouse), 39 other threatened fauna species listed under the *National Parks and Wildlife Act (SA)*, and one of the most diverse frog communities in South Australia. The Cooper Creek catfish and Cooper Creek turtle are endemic to the region. An abundance of flora species are also found in the reserve, with 20 listed as threatened under the *National Parks and Wildlife Act (SA).* Much of this region has been internationally recognised under the Ramsar Convention, which Australia is a signatory to, and by BirdLife International as a Key Biodiversity Area that supports significant proportions of the population of 22 species of native bird. As a regional reserve, the area is not only managed for the protection of natural and cultural values, but allows for grazing and utilisation of natural resources including oil and gas. Further challenging the integrity of the natural ecosystems are the effects of climate change. Whilst the area is naturally subject to large variations in rainfall and flooding events along the waterways leading to boom-and-bust events, temperatures are increasing (Appendix V) and there are prolonged periods of low rainfall.


INNAMINCKA
Coongie Lakes National Park
REGIONAL RESERVE
Coongie Road 2014
Cordillo Downs Road 2017, 2022
Loop Track 2015, 2019
Innamincka
Bore Track North 2013, 2018
Old Strzelecki Track 2015, 2019
142
154
Moomba
Della Satellite Gas Station

For these reasons, the Friends of the Innamincka Reserves commenced bird, mammal and vegetation surveys in the area in 2013 to provide an important data set for long-term monitoring of the natural values of the reserve. Survey sites have been established along four roadways radiating out from the Innamincka township - the Bore Track North (2013 & 2018), the Coongie Road (2014), the Old Strzelecki/ Loop Tracks (2015 & 2019) and the Cordillo Downs Road (2017 & 2022) using the methods described in this document. At this time the Coongie Rd survey had not been repeated due to a combination of flooding and the Covid pandemic which have prevented access to the area. These surveys cover all areas of the reserve that are accessible to the public under normal conditions. The survey procedures are well documented here and designed for ease of reproducibility, enabling repeat surveys to be conducted to assess long-term changes in the flora and fauna of the region. Bird data are entered into the Birdlife Australia database (Birdata) and the South Australian state fauna database. Other biological data (mammals, reptiles, invertebrates, plants) are entered into iNaturalist and then flow through to the Atlas of Living Australia. This report on birds, mammals and vegetation surveys is provided to IRR Park rangers, DEW regional managers, the State Library of SA, the National Archives of Australia and loaded on to the FOIR website.

In 2022 the Cordillo Rd survey was repeated. This was five years after the original survey. The repeat survey confirmed the ecological significance of this area. This was most apparent in the northern part of the survey area where there are fewer water points and consequently less cattle grazing. The lack of water points also reduces the pressure from other feral animals such as horses, donkeys and camels. Those areas closest to water points or where cattle gathered were generally in poorer condition.

Several census stops showed notable changes in vegetation over the five year period. Woody vegetation had declined at most points. *Acacia spp*. appeared to be most severely affected with widespread dead mulga and red mulga. The decline in red mulga was significant along creek lines. Eucalypt species along creek lines also showed noticable thinning of their crowns although the Bloodwoods in the north were less severely affected.

Smaller shrubs, less than 1.5m high seem to have been lost from most sites, although the red dunes were less affected and seemed in fairly good condition. Most ephemeral shrubs less than 0.5m were dead, particularly on areas of gibber plain.

There was a trend for spinifex hummocks to have expanded to areas where there had been shrubs during the original survey and for the spinifex hummocks to have grown larger along with increased recruitment of seedlings. This may be the ongoing recovery from fire as some burnt stumps were recorded in these areas.

Where the original survey found healthy spinifex, there was still a healthy spinifex community but with fewer shrubs.

The other notable change was that tussock grassland communities showed a decrease in density and cover. There was much more bare ground in these areas. This was particularly noticeable at those sites subject to the greatest grazing pressure.

Many of the observed changes may be attributed to changes in weather during the period between the surveys, although browsing pressure will also be a factor. Prior to the 2017 survey, there had been higher than average rainfall in 2016 and there were higher than average temperatures from 2017 – 2019. From 2020 to 2021, the Australian continent was subject to La Nina climate conditions. The closest active weather station during this time was at Moomba, some 130km from the survey area. Most of the intervening years had average or significantly below average rainfall, the exception being 2022 when there was a big rain event in January and more rain in April, however the closer but incomplete (for the year) Innamincka Station weather records show only half the rainfall in January. Temperatures at Moomba were generally lower than average. This information suggests that at the time of the 2017 survey, the vegetation was at or close to its peak except in those areas still recovering from past fires. Since then the cooler but generally drier conditions have resulted in a decline in vegetation and a decline in numbers for those bird species dependent on flowering vegetation. The wet conditions early in 2022 probably stimulated the growth of grasses and ephemeral herbs and shrubs which had declined by the time of the survey. These plants had, however, produced seed that were providing food for the abundant seed eaters (Zebra Finches, Budgerigars & Diamond Doves) that were recorded during this survey.

This survey complements the previous surveys carried out by this group over the past ten years. It continues the theme of the difficulty in managing a multi-use reserve such as this where there are the competing interests of cattle grazing, the oil and gas industry, and conservation. The environmental impact is greatest where there is cattle grazing close to water points. While there are not large weed infestations in the survey area, both Buffel Grass and *Vachellia farnesiana* incursions are found in the most disturbed areas. Roading associated with the mining and grazing industries is probably facilitating the spread of these weeds beyond the public roads and so should be monitored carefully. During all the surveys conducted by the FOIR evidence of earlier aboriginal occupancy has been seen such as worked stones, grinding stones and middens, emphasising the additional overall need to respect aboriginal heritage and protect cultural sites in the area.

Erratum: In the report from the 2017 survey *Grevillea juncifolia* was reported from CR02, transect F. This identification was incorrect and should have been *Acacia sericophylla*, Cork-Bark Wattle *(*Appendix IV CR02, Transect F*)*

APPENDIX I – LOCATION OF CENSUS STOPS

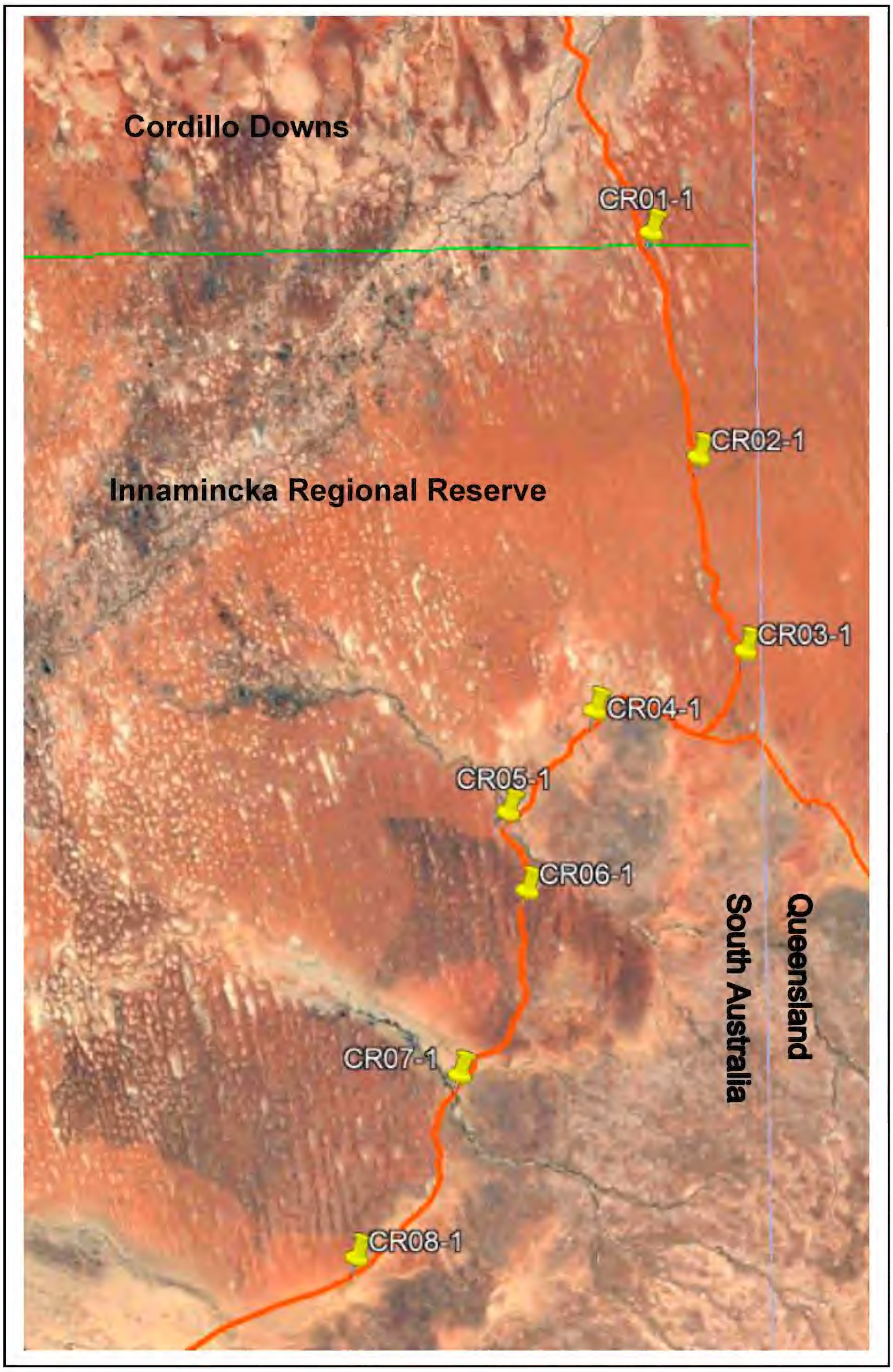
A. CENSUS STOP AND CORNER POINT CO-ORDINATES

The following table lists the co-ordinates recorded for each census stop for both the baseline 2017 survey and the repeat 2022 survey. The co-ordinate system used is UTM. The census stops are also shown on the following Map.

Census Stop	Corner Point	AMG zone	Easting	Northing
CR01	1	54J	494941	7026920
	2	54J	495441	7026920
	3	54J	495441	7026420
	4	54J	494941	7026420
	5	54J	494441	7026920
	6	54J	494441	7027420
	7	54J	494941	7027420
CR02	1	54J	496951	7016692
	2	54J	497451	7016692
	3	54J	497451	7016192
	4	54J	496951	7016192
	5	54J	496451	7016692
	6	54J	496451	7017192
	7	54J	496951	7017192
CR03	1	54J	498953	7007863
	2	54J	499453	7007863
	3	54J	499453	7007363
	4	54J	498953	7007363
	5	54J	498453	7007863
	6	54J	498453	7008363
	7	54J	498953	7008363
CR04	1	54J	492021	7005245
	2	54J	492521	7005245
	3	54J	492521	7004745
	4	54J	492021	7004745
	5	54J	491521	7005245
	6	54J	491521	7005745
	7	54J	492021	7005745
CR05	1	54J	487983	7000695
	2	54J	488483	7000695
	3	54J	488483	7000195
	4	54J	487983	7000195
	5	54J	487483	7000695
	6	54J	487483	7001195
	7	54J	487983	7001195
CR06	1	54J	488787	6997135
	2	54J	489287	6997135
	3	54J	489287	6996635
	4	54J	488787	6996635
	5	54J	488287	6997135
	6	54J	488287	6997635
	7	54J	488787	6997635

Census Stop	Corner Point	AMG zone	Easting	Northing
CR07	1	54J	485550	6988804
	2	54J	486050	6988804
	3	54J	486050	6988304
	4	54J	485550	6988304
	5	54J	485050	6988804
	6	54J	485050	6989304
	7	54J	485550	6989304
CR08	1	54J	480698	6980551
	2	54J	481198	6980551
	3	54J	481198	6980051
	4	54J	480698	6980051
	5	54J	480198	6980551
	6	54J	480198	6981051
	7	54J	480698	6981051

B. MAP SHOWING CENSUS STOP LOCATIONS ALONG THE CORDILLO DOWNS ROAD



Source: VantagePoint™/DigitalGlobe™ overlaid with FOIR census stop co-ordinates

Key

Major roads ▬

15 km

APPENDIX II - BIRD SURVEY DATA
Combined data for all 8 transects at each census stop

Date and time	Census Stop	Species	Seen/ Heard	Number	GPS
04/08/2022	CR01	Australian Hobby	Seen	1	54 J
St. 08:45		Black-faced Woodswallow	Seen	8	494941
Fin. 12:20		Budgerigar	Heard	**2**	7026920N
		Budgerigar	Seen	409	
		Chestnut-rumped Thornbill	Seen	2	
		Corvid	Seen	8	
		Crimson Chat	Seen	**4**	
		Galah	Seen	12	
		Little Buttonquail	Seen	1	
		Little Corella	Seen	10	
		Little Crow	Seen	31	
		Nankeen Kestrel	Seen	2	
		Red-backed Kingfisher	Seen	2	
		Whistling Kite	Seen	1	
		White-winged Fairywren	Heard	3	
		White-winged Fairywren	Seen	6	
		Willie Wagtail	Seen	1	
		Yellow-throated Miner	Heard	4	
		Yellow-throated Miner	Seen	2	
		Zebra Finch	Heard	1	
		Zebra Finch	Seen	209	
				719	

Date and time	Census Stop	Species	Seen/ Heard	Number	GPS
31/07/2022	CR02	Black Honeyeater	Heard	2	54J
St. 09:40		Black Honeyeater	Seen	**2**	496951E
Fin. 13:40		Brown Falcon	Seen	4	7016692N
		Budgerigar	Heard	3	
		Budgerigar	Seen	20	
		Little Crow	Seen	46	
		Nankeen Kestrel	Seen	3	
		Pied Honeyeater	Seen	2	
		Stubble Quail	Seen	1	
		White-winged Fairywren	Heard	2	
		Zebra Finch	Seen	52	
				137	

Date and time	Census Stop	Species	Seen/ Heard	Number	GPS
01/08/2022	CR03	Black Honeyeater	Seen	13	54J
St. 09:10		Brown Falcon	Seen	1	498953E
Fin. 12:40		Budgerigar	Heard	1	7007863N
		Budgerigar	Seen	120	
		Cockatiel	Seen	7	
		Corvid	Seen	6	
		Crimson Chat	Seen	45	

		Little Buttonquail	Seen	2	
		Little Crow	Seen	6	
		Nankeen Kestrel	Seen	2	
		Stubble Quail	Seen	1	
		White-winged Fairywren	Heard	3	
		Zebra Finch	Heard	1	
		Zebra Finch	Seen	37	
				244	

02/08/2022	CR04	Australian Pelican (overhead)	Seen	1	54J
St. 08:30		Australian Raven	Seen	3	492021E
Fin. 12:40		Banded Whiteface	Seen	2	7005247N
		Black Kite	Seen	1	
		Black-faced Woodswallow	Seen	2	
		Black-fronted Dotterel	Seen	1	
		Budgerigar	Heard	6	
		Budgerigar	Seen	154	
		Chirruping Wedgebill	Heard	2	
		Cockatiel	Seen	12	
		Corvid	Seen	3	
		Crested Pigeon	Seen	4	
		Crimson Chat	Seen	10	
		Diamond Dove	Seen	16	
		Galah	Seen	3	
		Little Buttonquail	Seen	10	
		Little Corella	Seen	2	
		Little Crow	Seen	8	
		Nankeen Kestrel	Seen	3	
		Red-kneed Dotterel	Seen	1	
		Redthroat	Heard	1	
		Singing Honeyeater	Seen	1	
		Wedge-tailed Eagle	Seen	1	
		White-backed Swallow	Seen	2	
		White-winged Fairywren	Seen	5	
		Willie Wagtail	Seen	3	
		Zebra Finch	Seen	774	
				1030	

30/07/2022	CR05	Australian Raven	Heard	2	54J
St. 15:25		Australian Raven	Seen	1	487983E
Fin. 17:15		Black Honeyeater	Heard	**2**	7000695N
31/07/2022		Black-faced Woodswallow	Seen	5	
St. 15:50		Bourke's Parrot	Seen	2	
Fin. 17:20		Brown Falcon	Seen	**3**	
		Budgerigar	Heard	1	
		Budgerigar	Seen	112	
		Cockatiel	Seen	4	
		Crested Pigeon	Seen	5	

		Diamond Dove	Seen	214	
		Galah	Heard	1	
		Galah	Seen	2	
		Grey Fantail	Seen	1	
		Red-backed Kingfisher	Seen	1	
		Red-capped Robin	Heard	1	
		Red-capped Robin	Seen	2	
		Singing Honeyeater	Heard	4	
		Singing Honeyeater	Seen	3	
		Willie Wagtail	Heard	1	
		Willie Wagtail	Seen	9	
		Zebra Finch	Seen	133	

509

01/08/2022	CR06	Black Honeyeater	Heard	1	54J
St. 15:25		Black-faced Woodswallow	Seen	2	489289E
Fin. 16:55		Brown Falcon	Seen	**3**	6996636N
02/08/2022		Budgerigar	Seen	20	
St. 15:30		Cockatiel	Seen	4	
Fin. 16:46		Corvid	Seen	2	
		Diamond Dove	Seen	97	
		Little Buttonquail	Seen	5	
		Little Corella	Seen	70	
		Little Crow	Heard	1	
		Little Crow	Seen	10	
		Nankeen Kestrel	Seen	2	
		White-winged Fairywren	Heard	3	
		White-winged Fairywren	Seen	6	
		Zebra Finch	Heard	6	
		Zebra Finch	Seen	129	

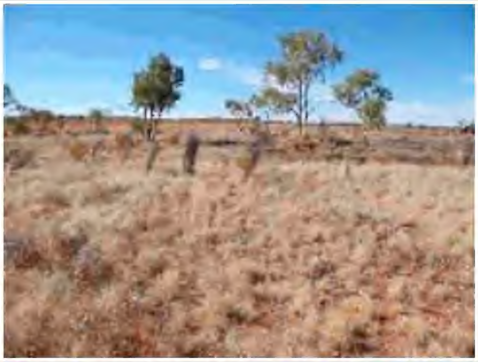
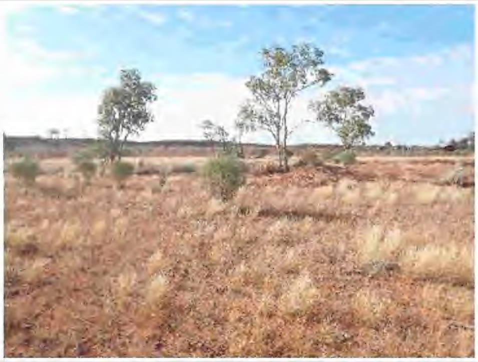
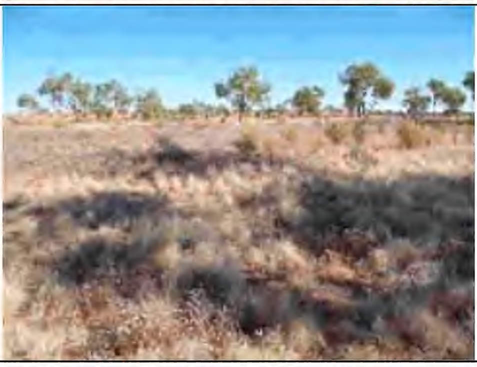
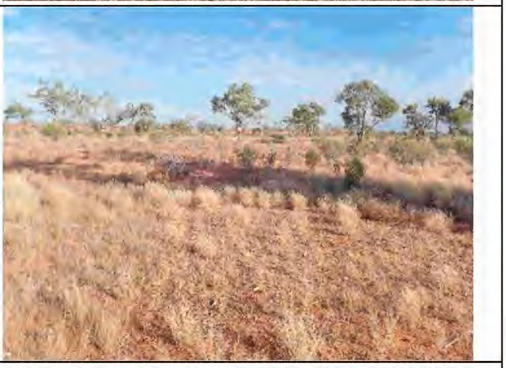
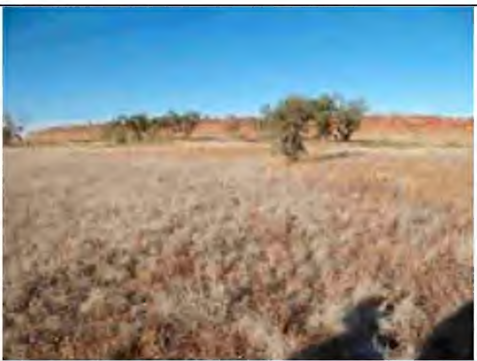
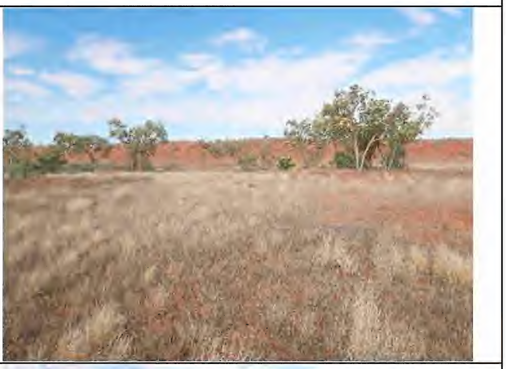
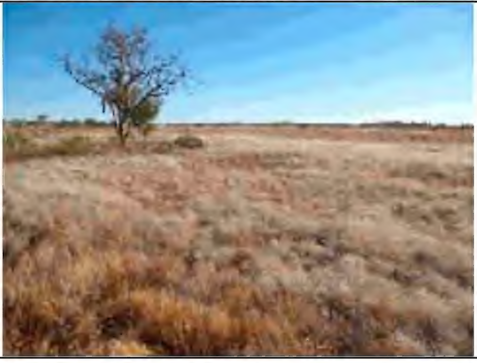
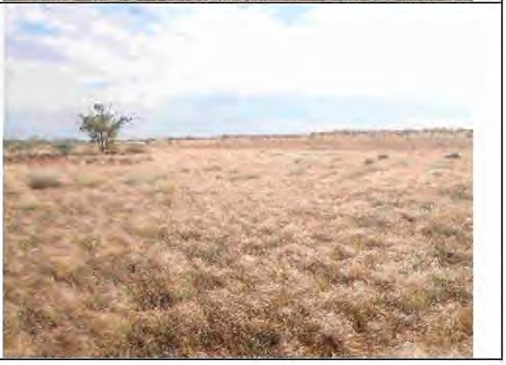
361

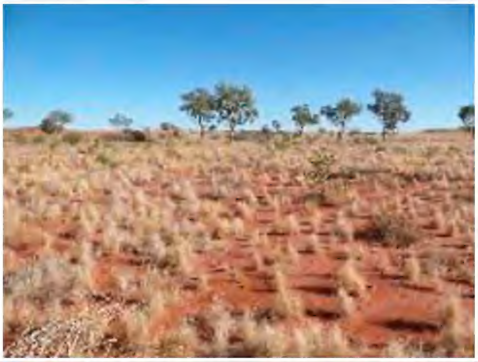
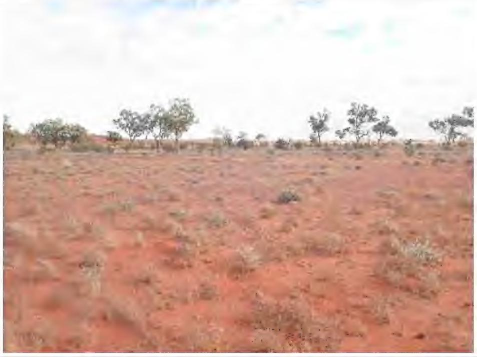
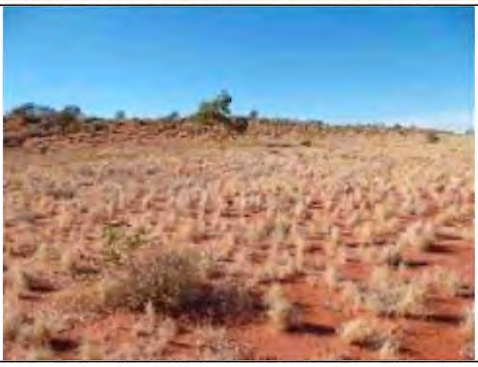
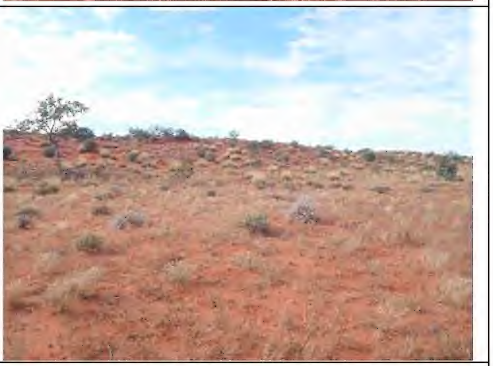
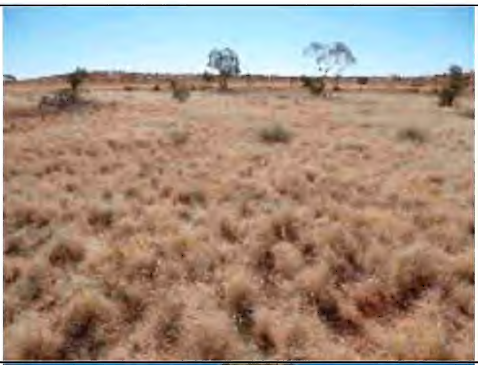
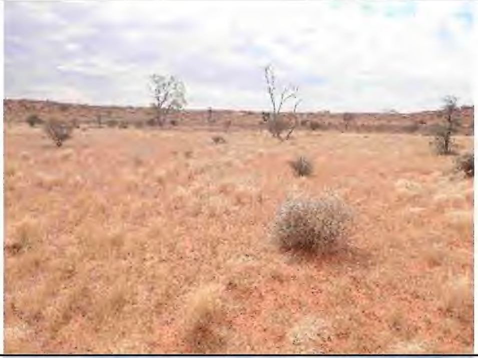
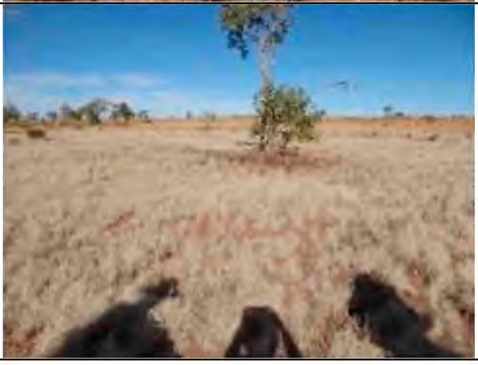
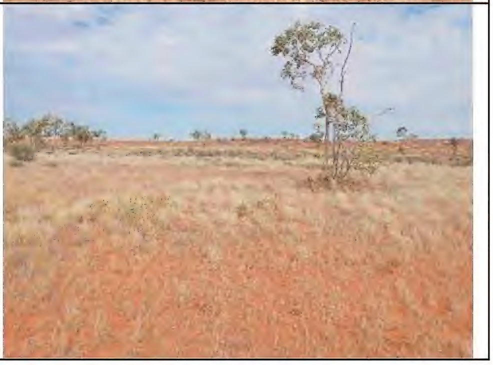
30/07/2022	CR07	Australian Owlet-nightjar	Seen	1	54J
St. 09:36		Black Kite	Seen	1	485650E
Fin. 13:07		Black-faced Cuckooshrike	Seen	1	6988804N
		Black-faced Woodswallow	Seen	3	
		Bourke's Parrot	Seen	8	
		Brown Falcon	Seen	1	
		Budgerigar	Heard	1	
		Chestnut-rumped Thornbill	Seen	1	
		Corvid	Seen	6	
		Galah	Seen	49	
		Little Crow	Heard	10	
		Purple-backed Fairywren	Seen	2	
		Red-capped Robin	Seen	3	
		Singing Honeyeater	Heard	5	
		Tree Martin	Seen	1	
		White-winged Fairywren	Heard	4	

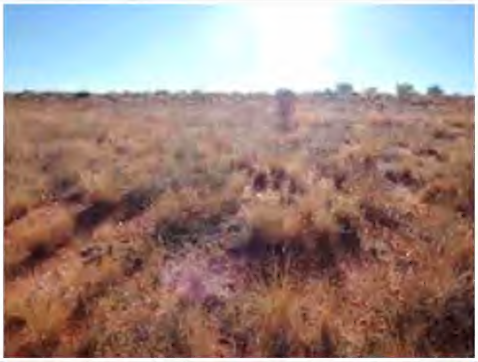
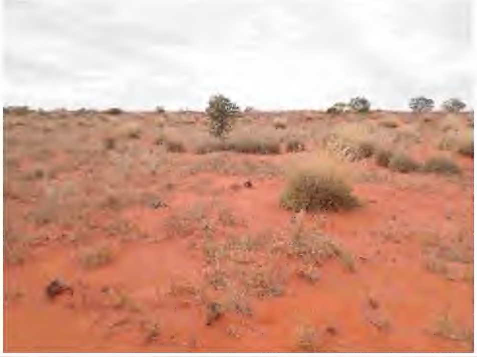
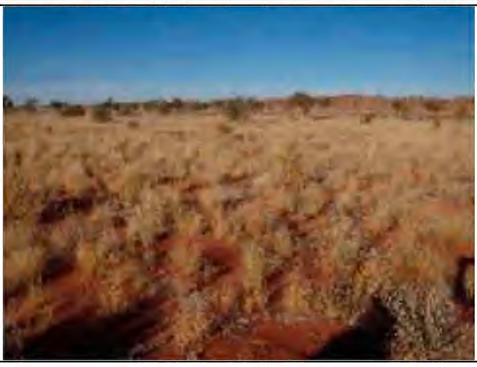
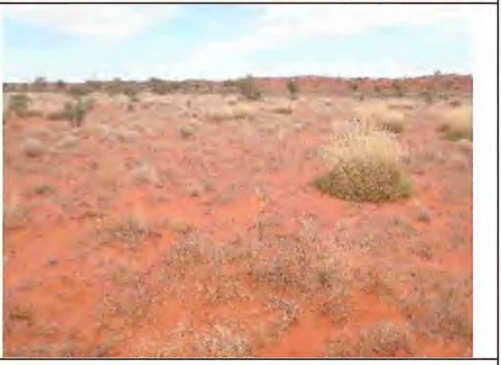
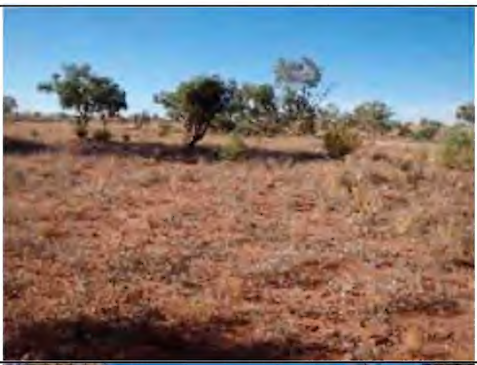
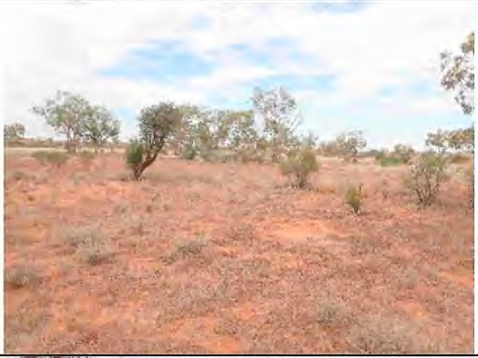
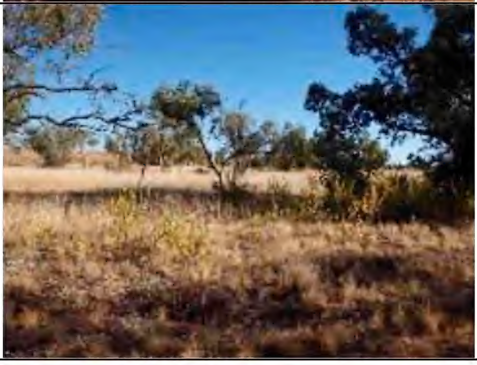
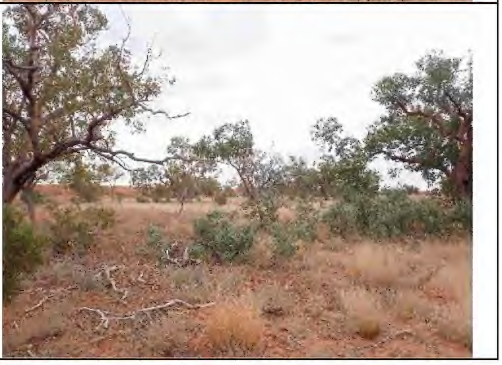
		Willie Wagtail	Heard	1	
		Willie Wagtail	Seen	2	
		Zebra Finch	Seen	21	
				121	

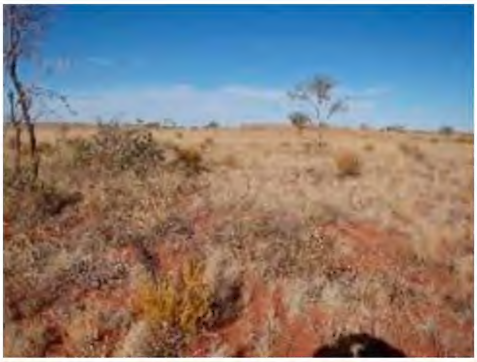
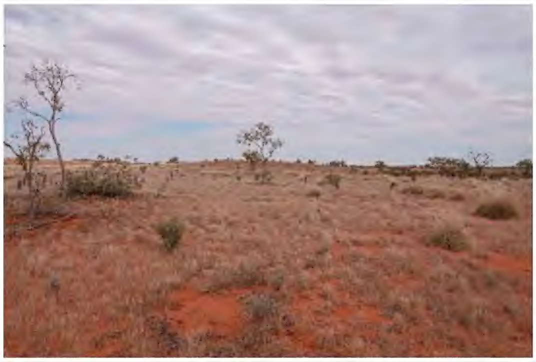
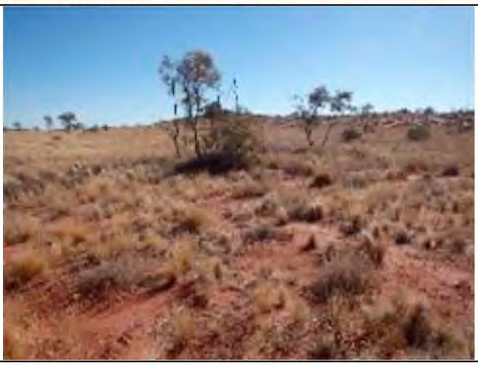
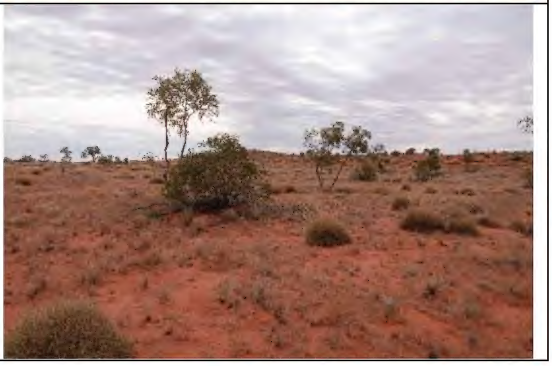
29/07/2022	CR08	Australian Raven	Seen	4	54J
St. 10:50		Black Kite	Seen	1	480698E
Fin. 15:25		Black-faced Woodswallow	Seen	18	6980551N
		Bourke’s Parrot	Seen	1	
		Brown Falcon	Seen	2	
		Budgerigar	Seen	112	
		Chirruping Wedgebill	Heard	2	
		Cinnamon Quail-thrush	Seen	2	
		Corvid	Seen	3	
		Crested Pigeon	Seen	12	
		Crimson Chat	Seen	2	
		Galah	Seen	26	
		Little Corella	Seen	150	
		Nankeen Kestrel	Seen	1	
		Singing Honeyeater	Heard	1	
		Singing Honeyeater	Seen	3	
		Willie Wagtail	Seen	2	
		Yellow-throated Miner	Heard	1	
		Zebra Finch	Seen	63	
				406	

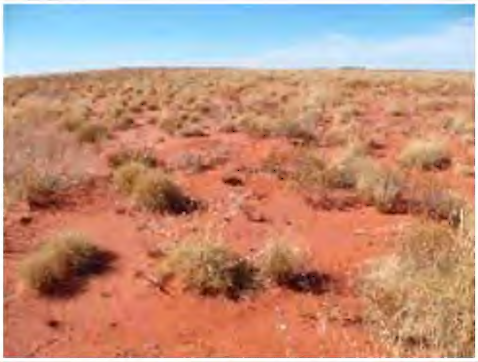
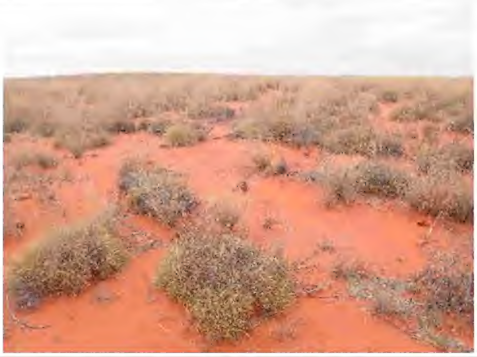
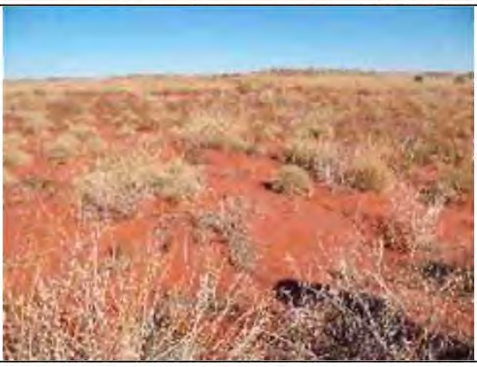
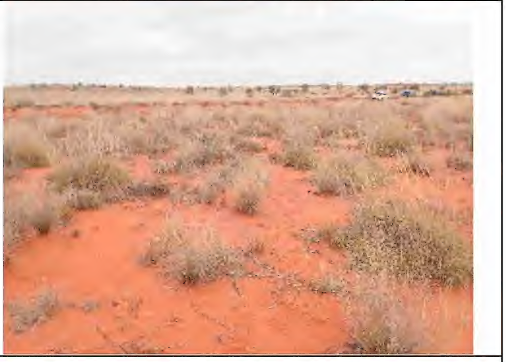
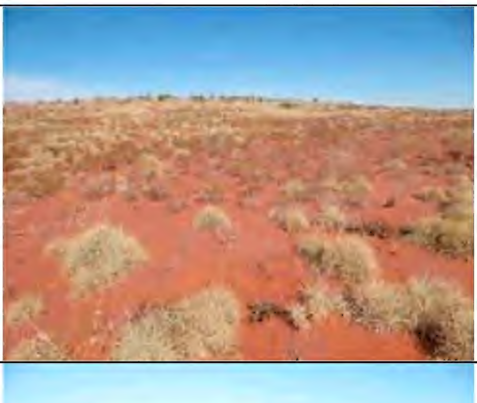
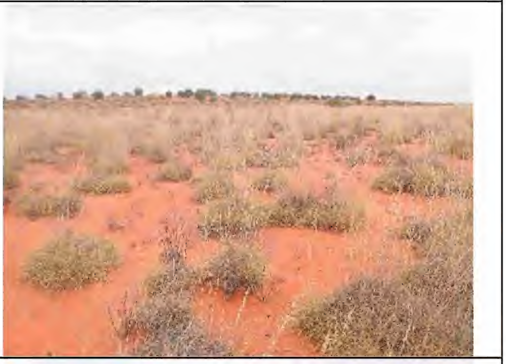
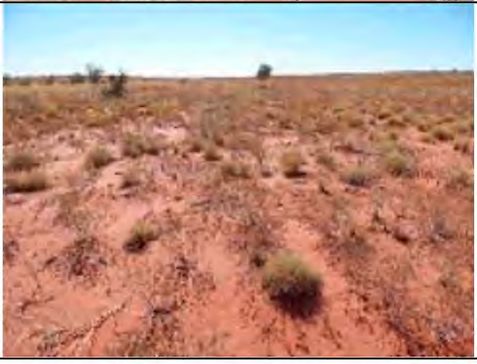
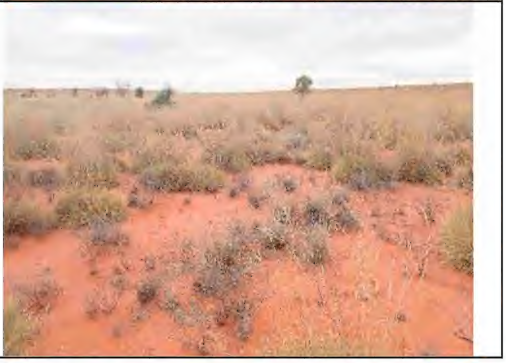
APPENDIX III – CORNER POINT PHOTOS: 2017 vs 2022

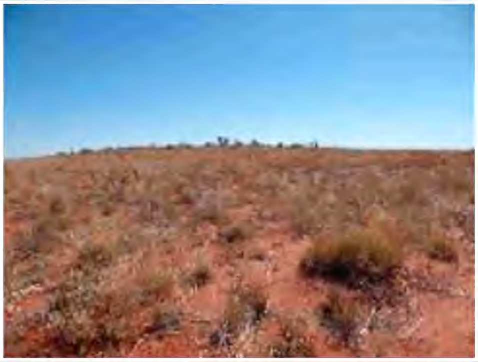
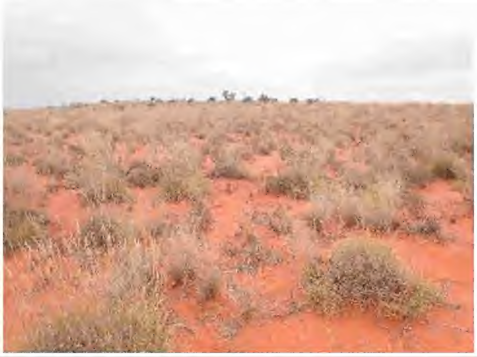
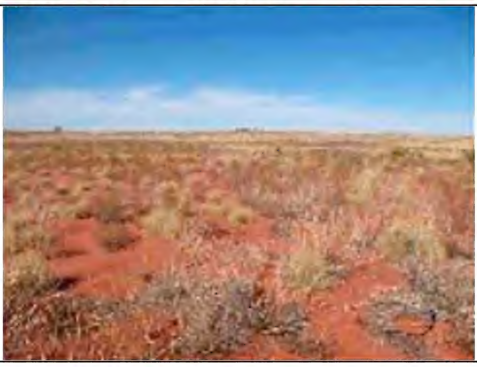
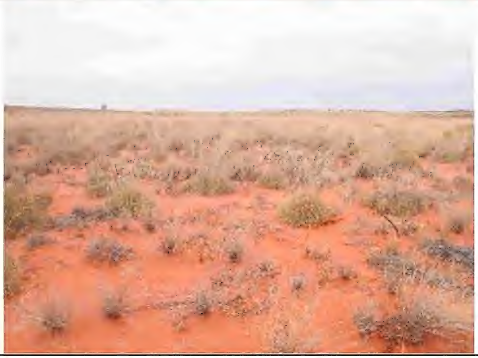
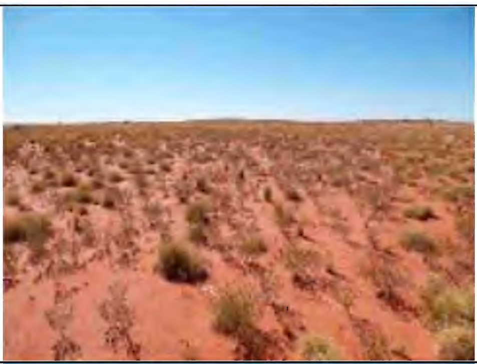
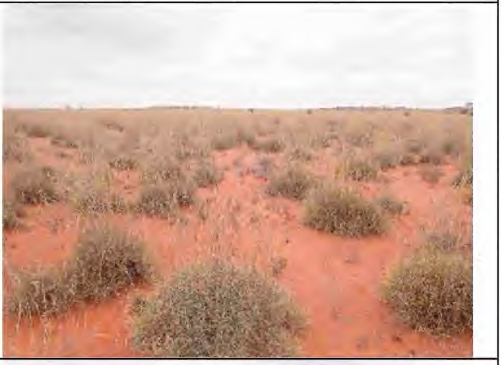
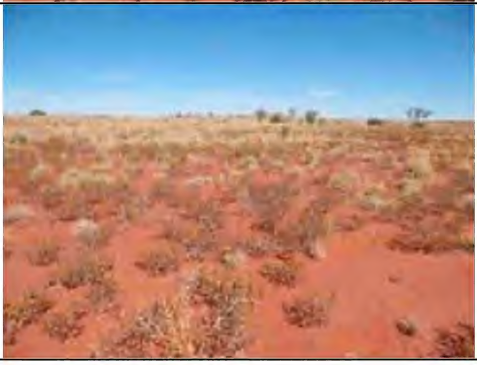
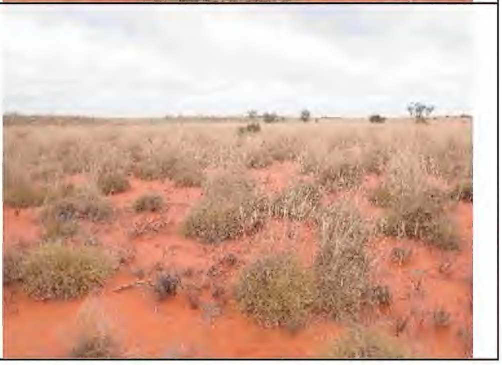
Census stop 1	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

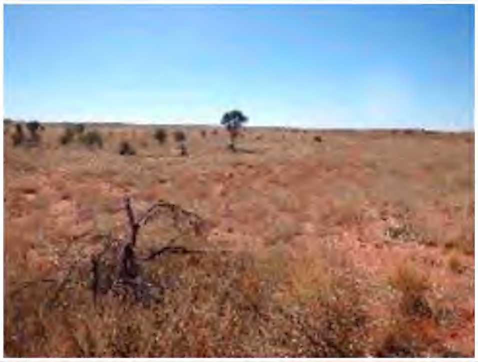
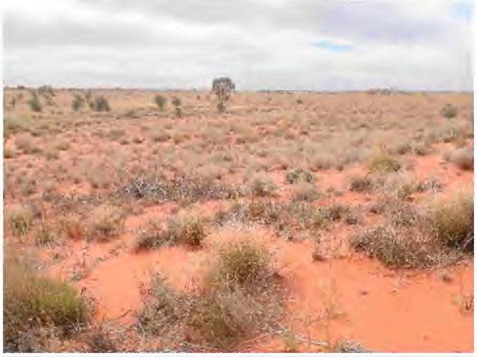
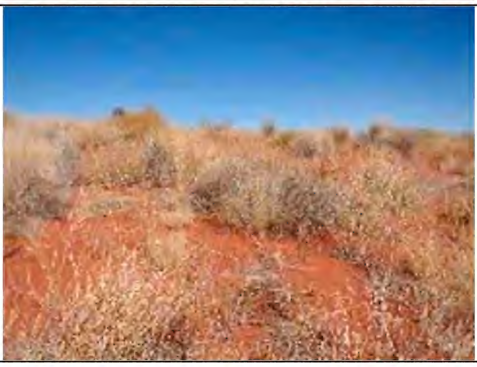
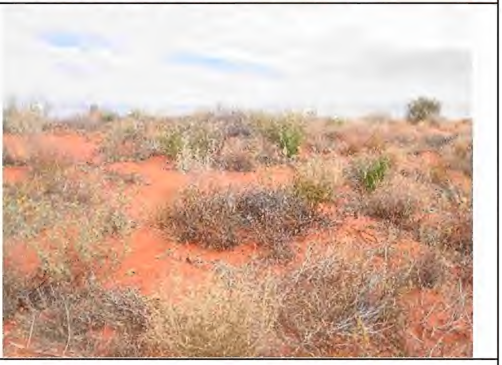
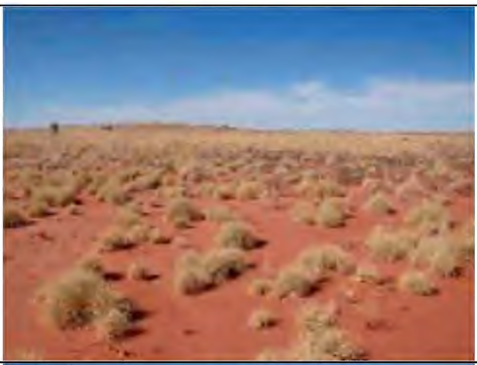
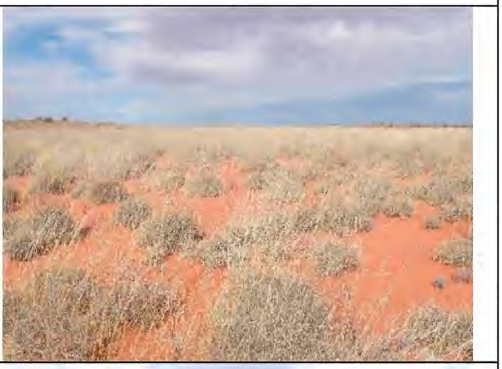
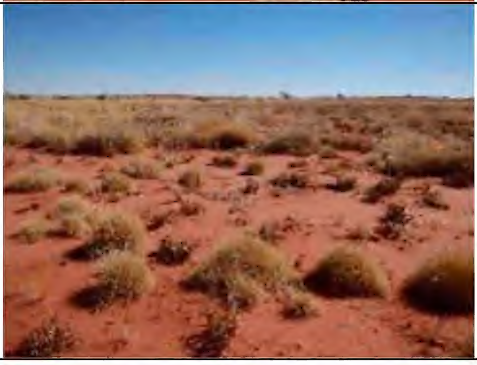
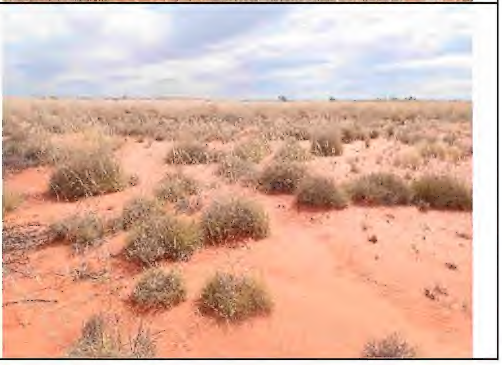
Census stop 1	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

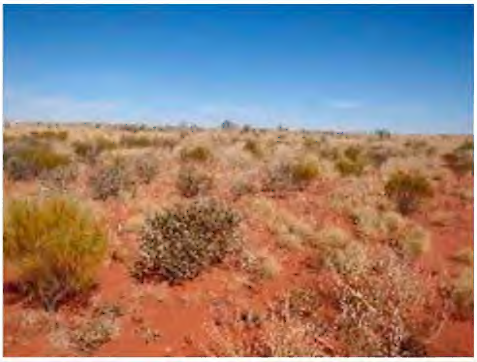
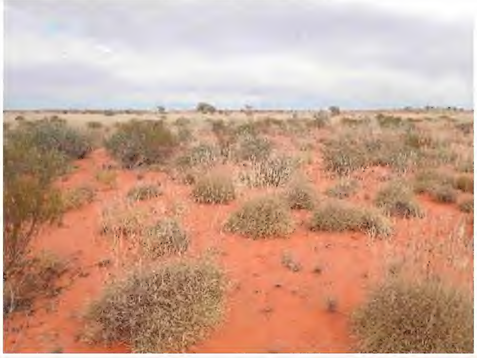
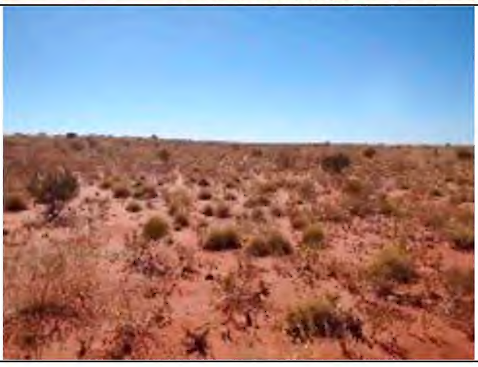
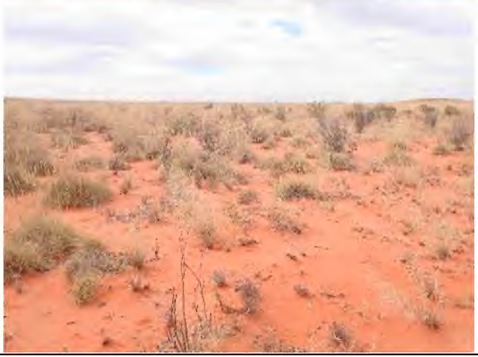
Census stop 1	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

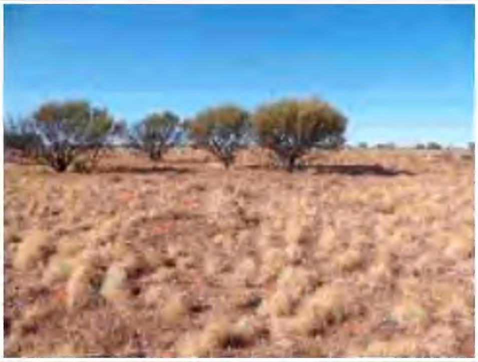
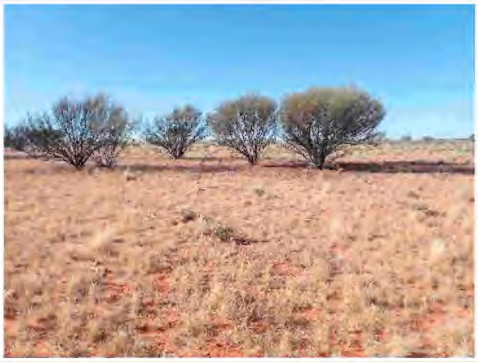
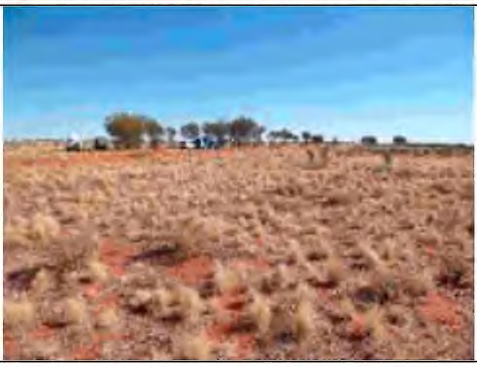
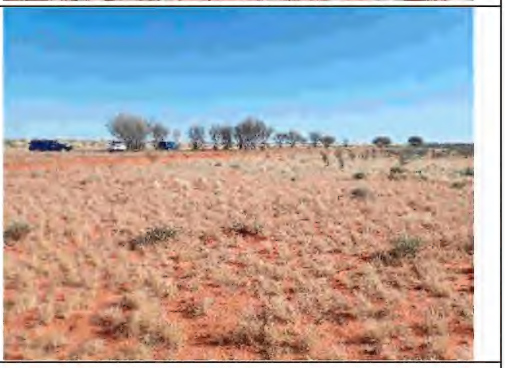
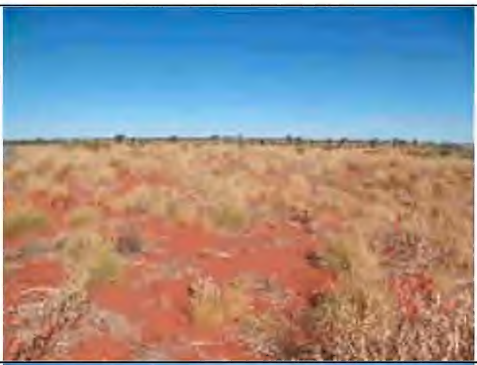
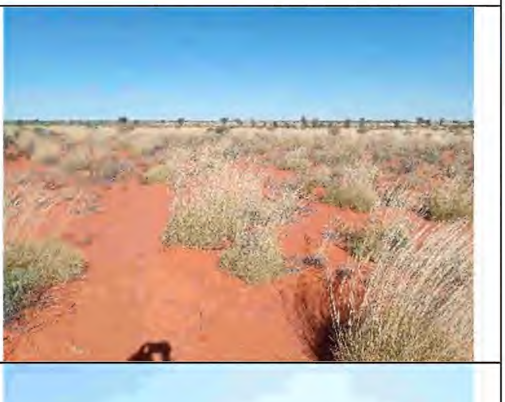
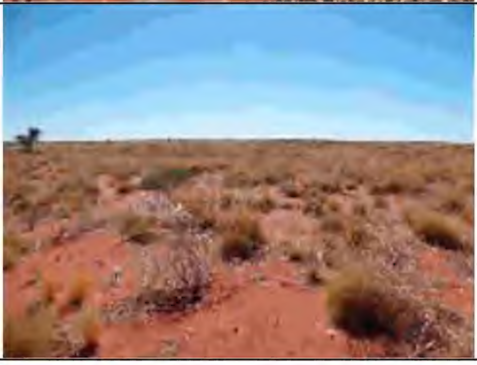
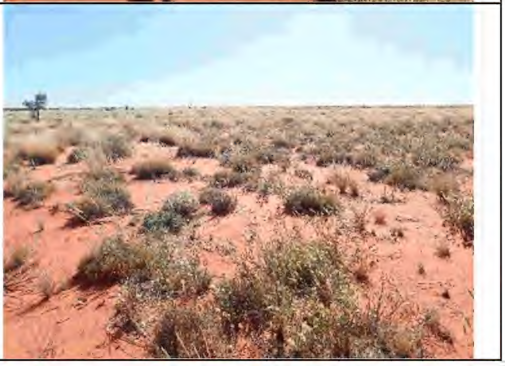
Census stop 1	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

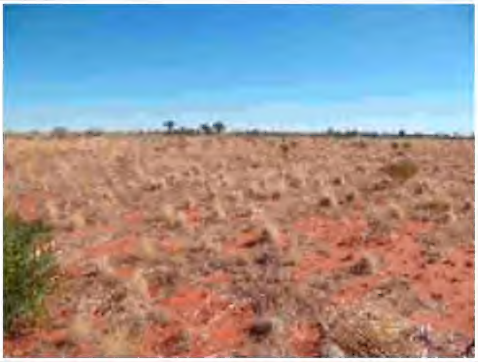
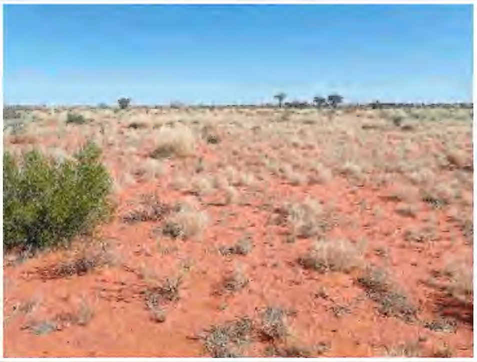
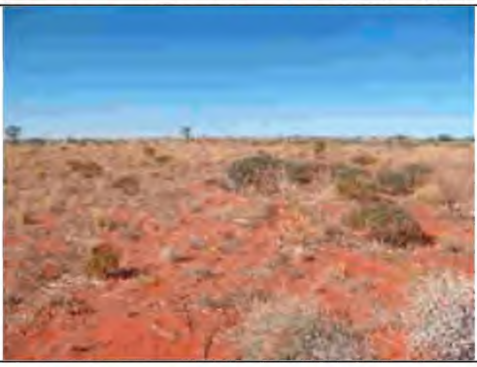
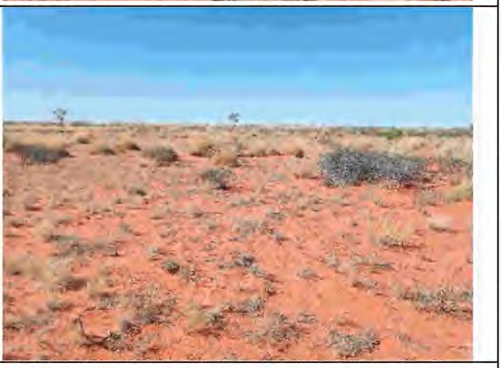
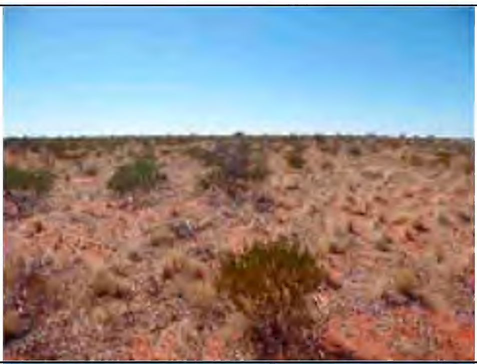
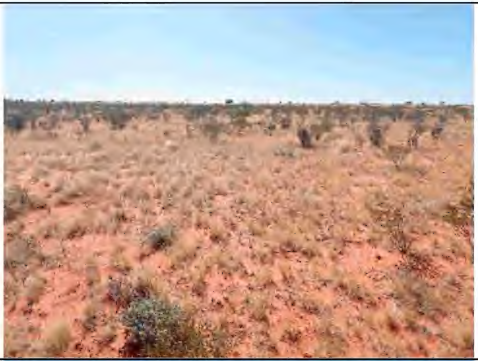
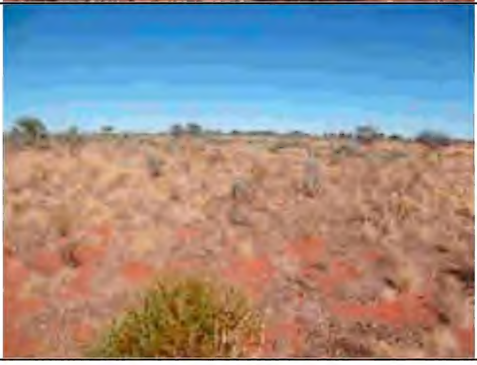
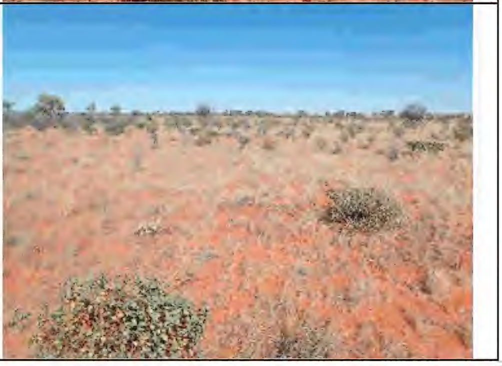
Census stop 2	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

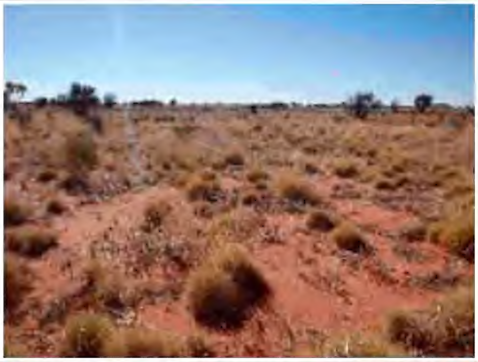
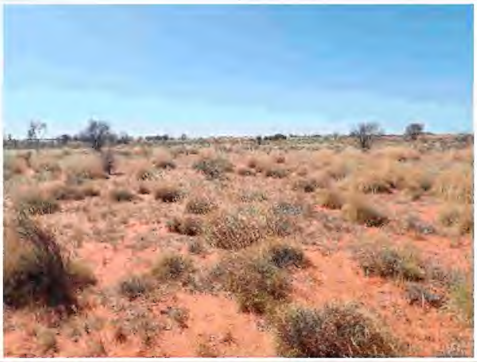
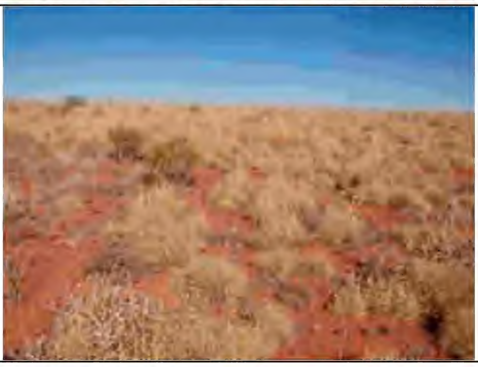
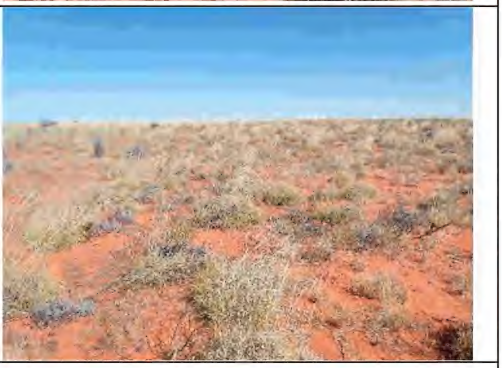
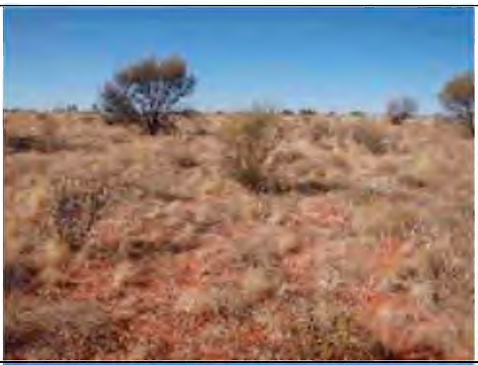
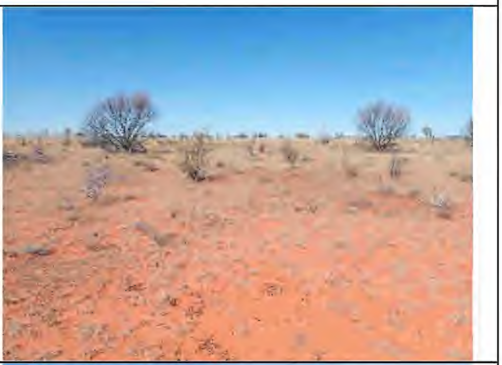
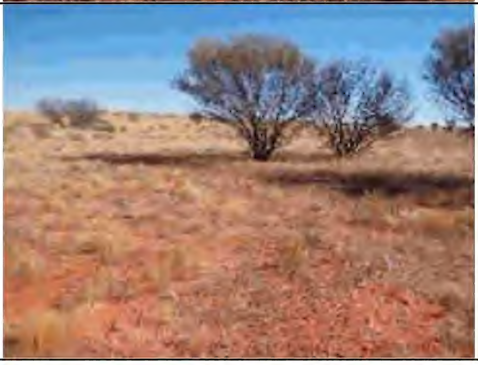
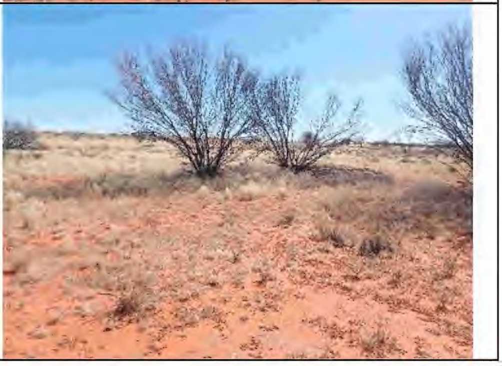
Census stop 2	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

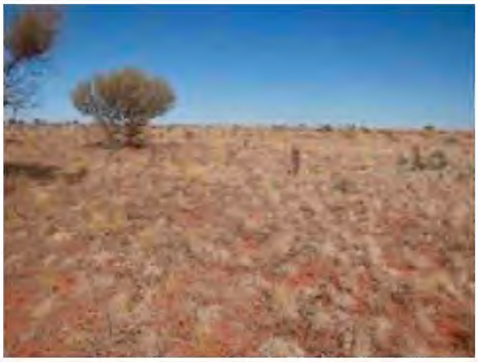
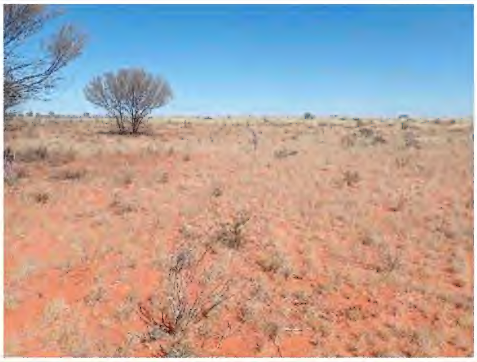
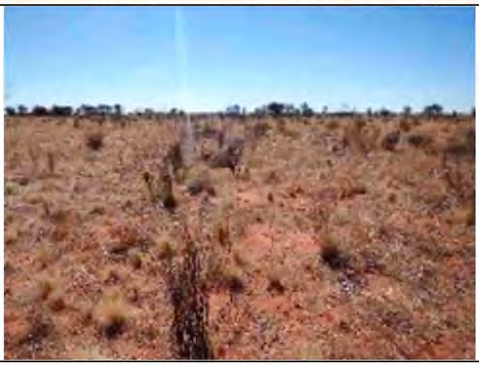
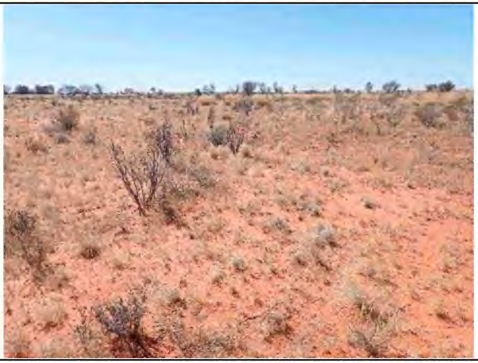
Census stop 2	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

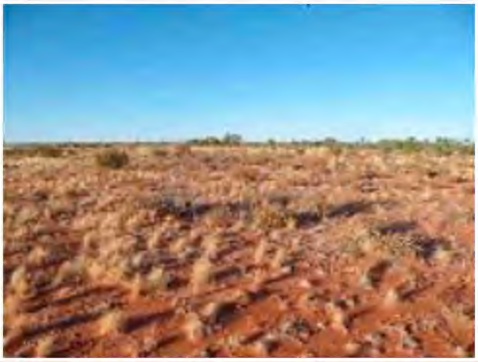
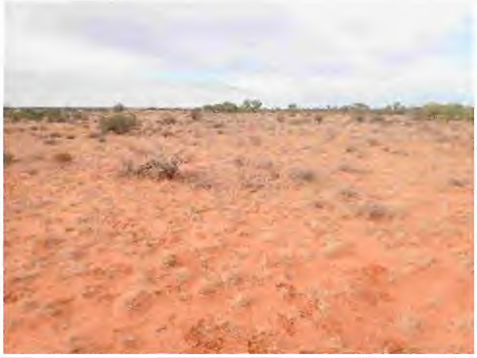
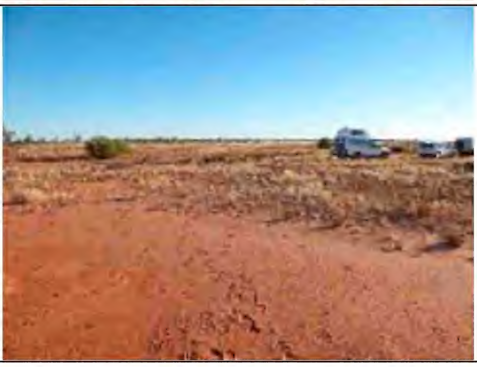
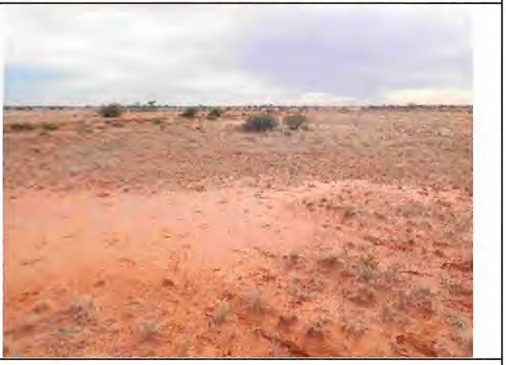
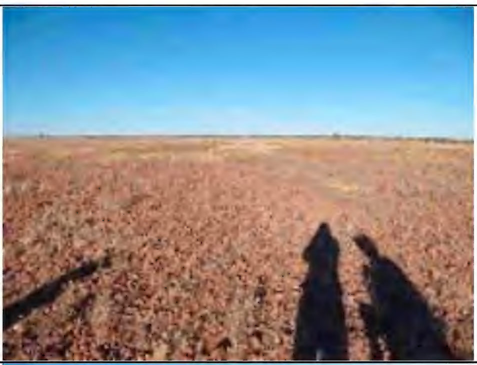
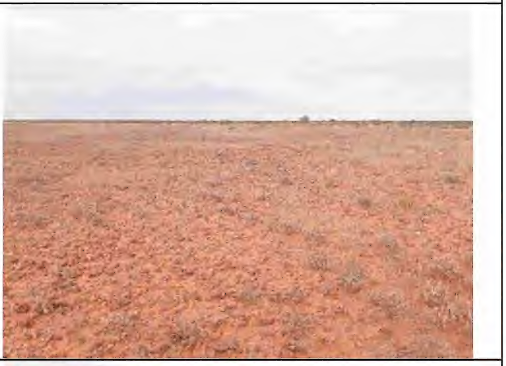
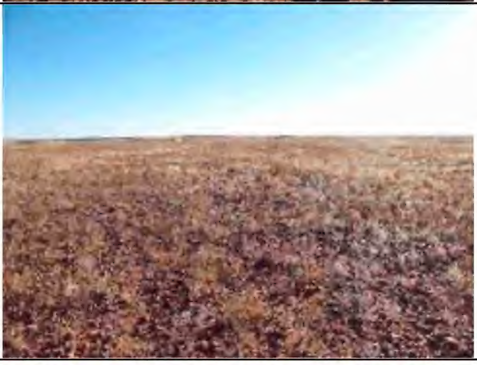
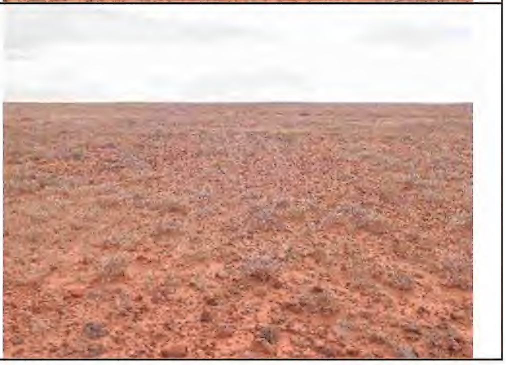
Census stop 2	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

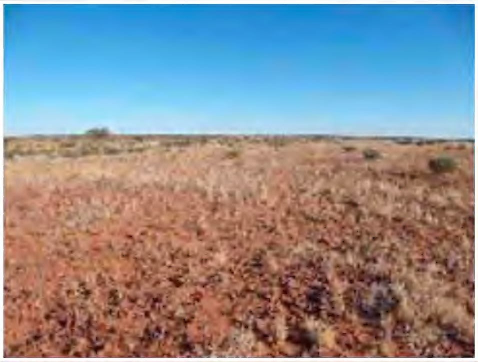
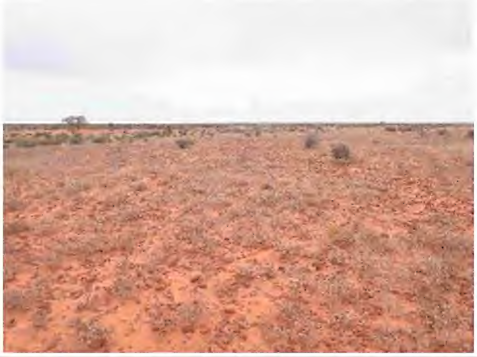
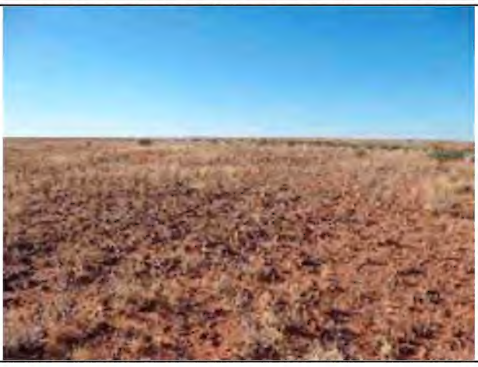
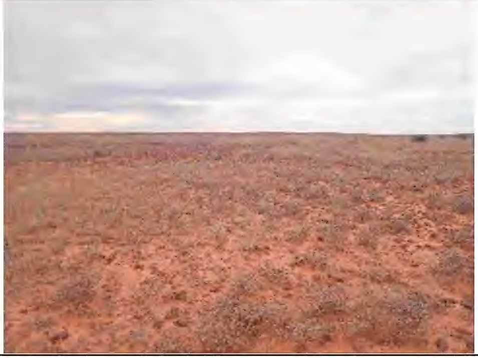
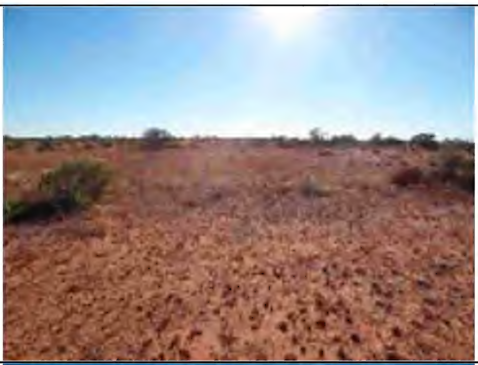
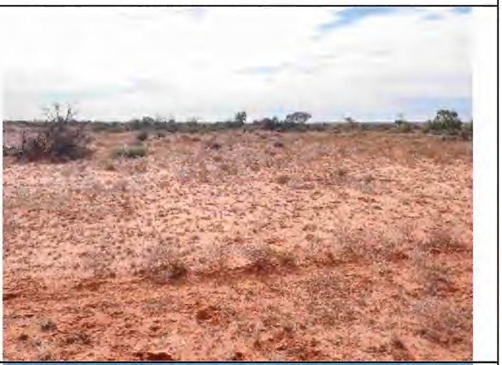
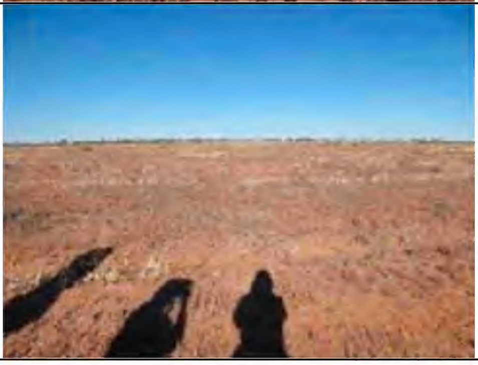
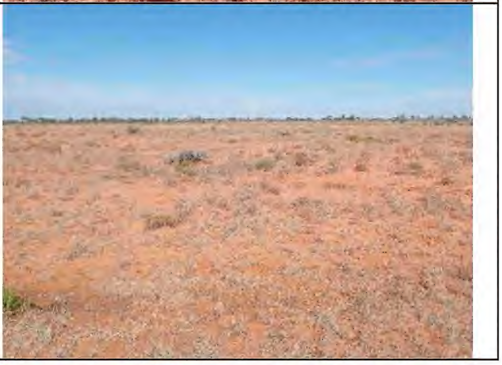
Census stop 3	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

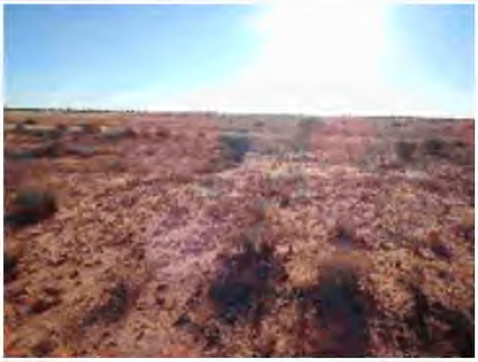
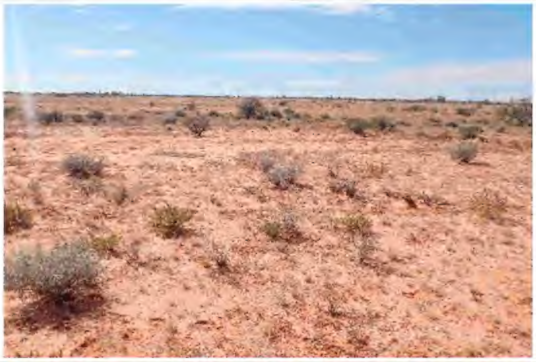
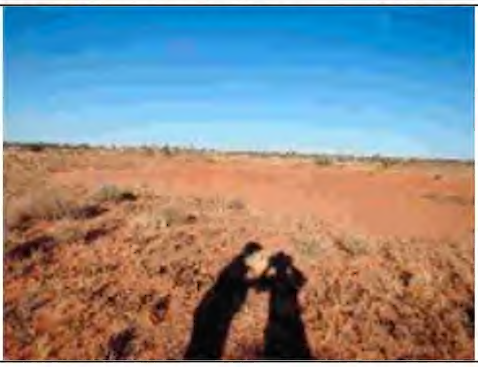
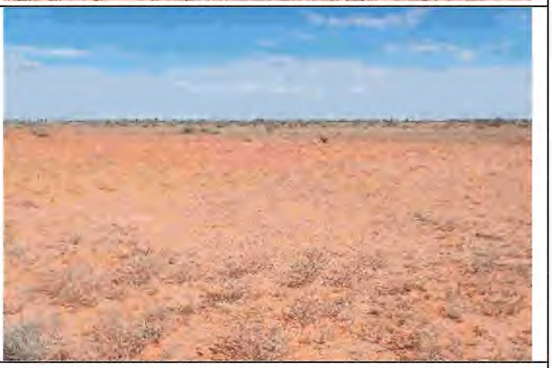
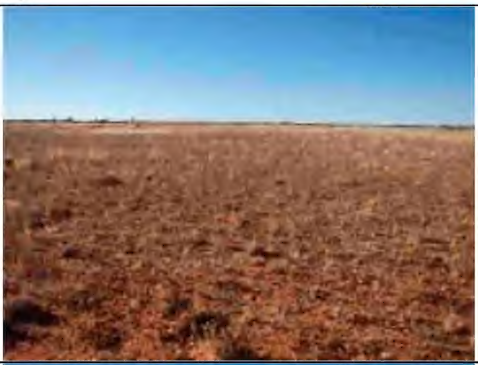
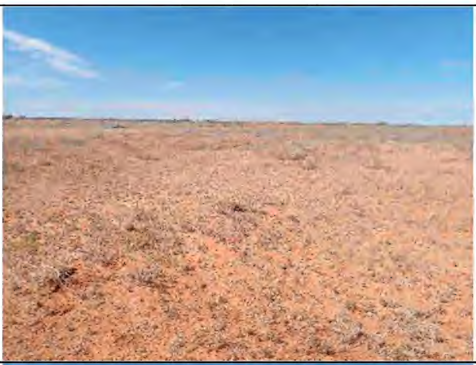
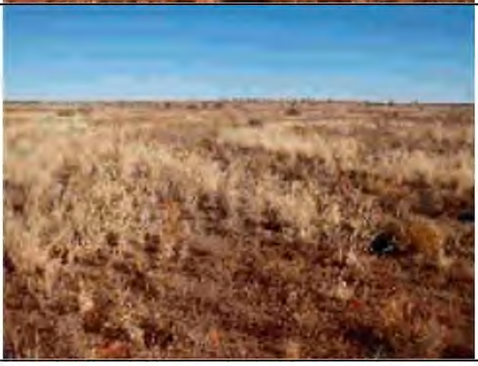
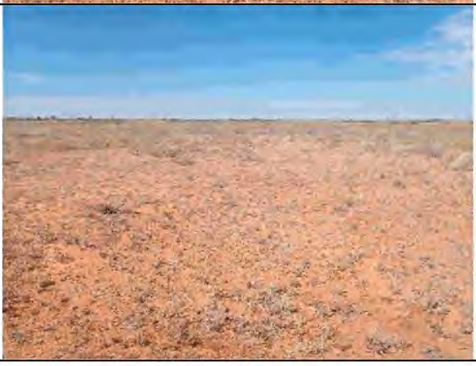
Census stop 3	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

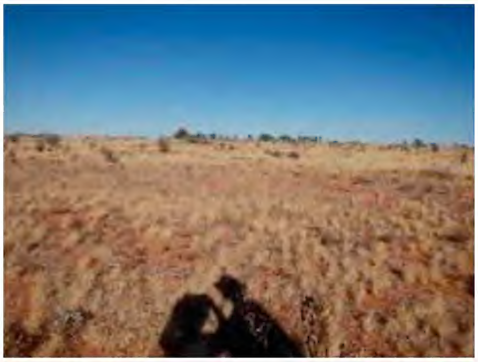
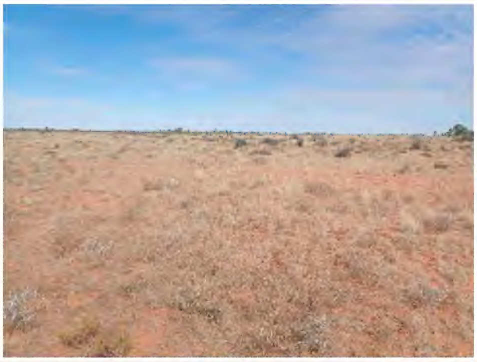
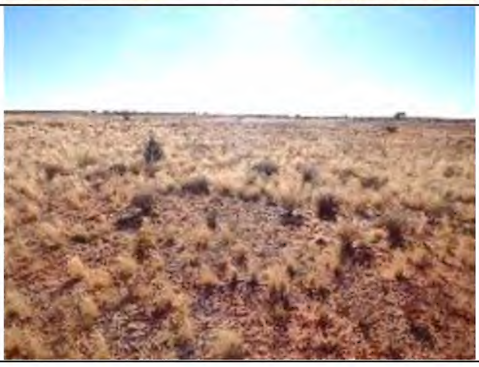
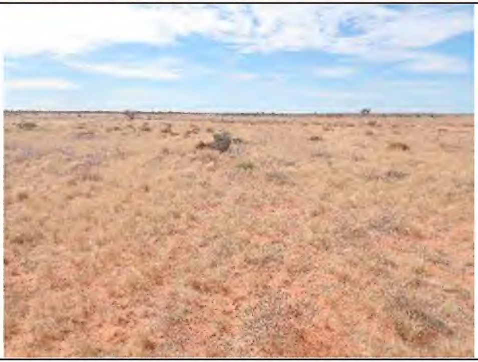
Census stop 3	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

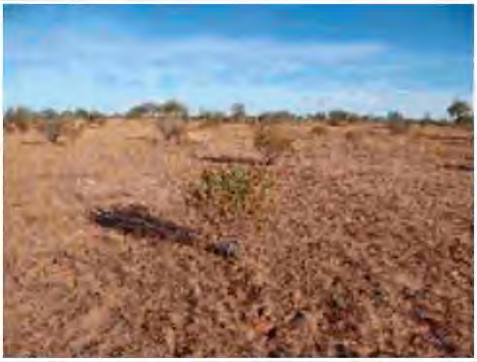
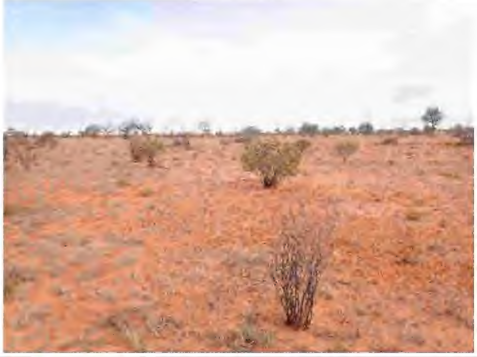
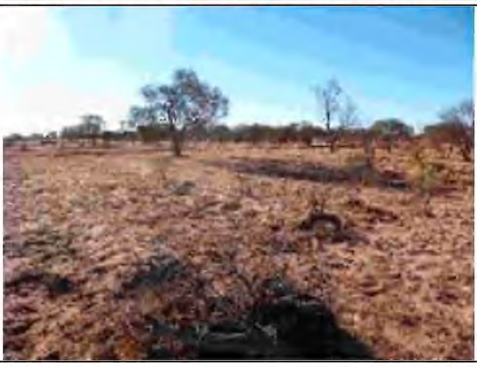
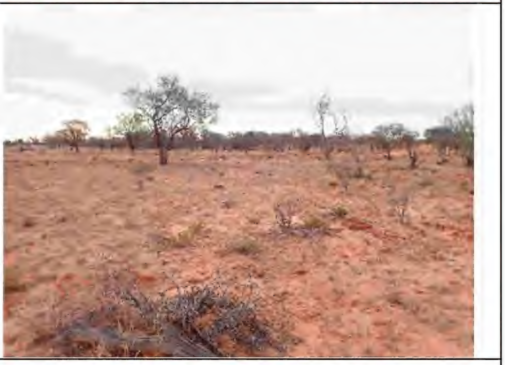
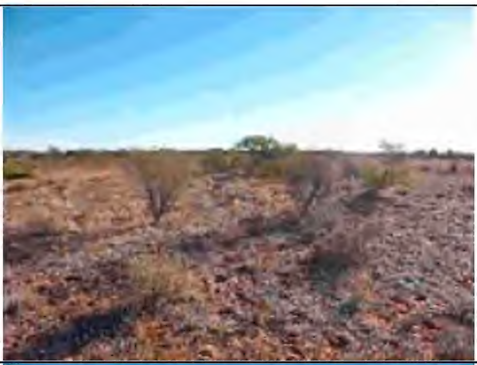
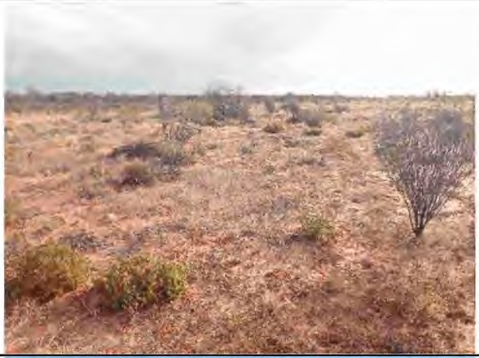
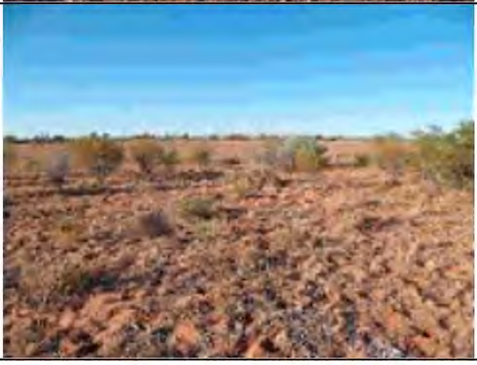
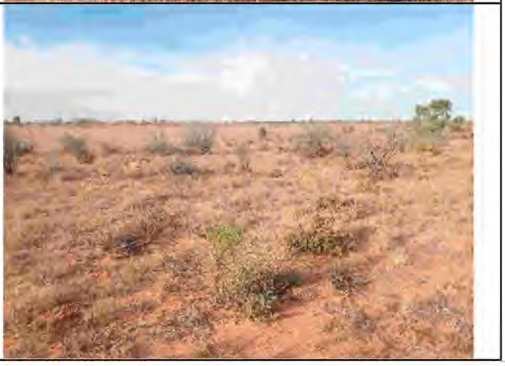
Census stop 3	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

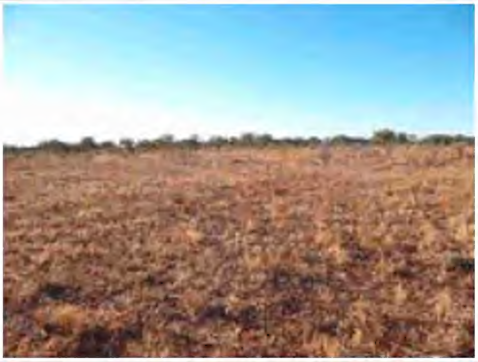
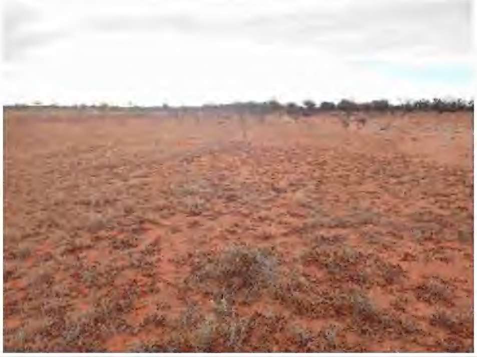
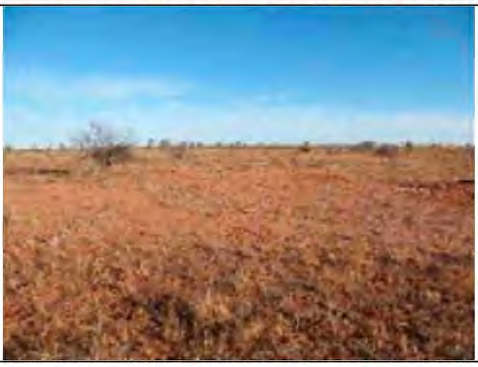
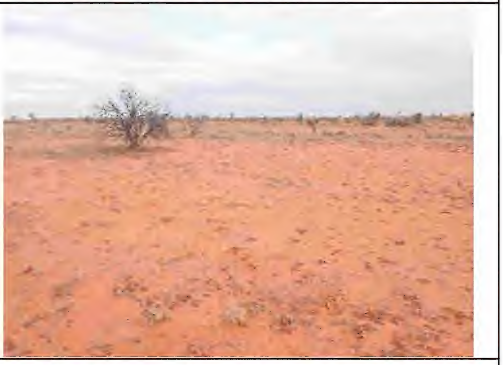
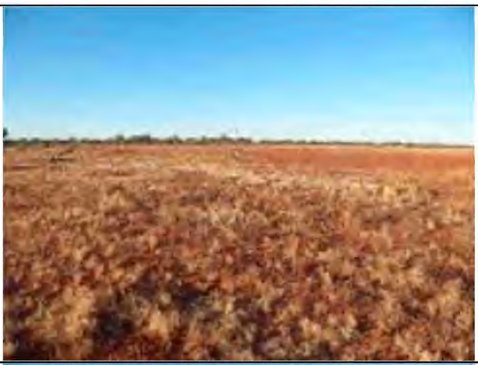
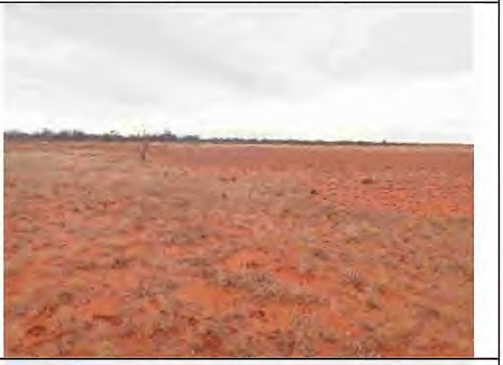
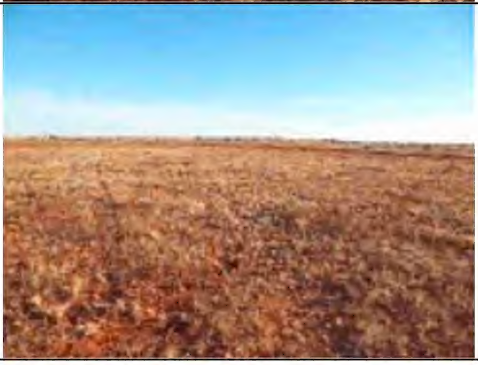
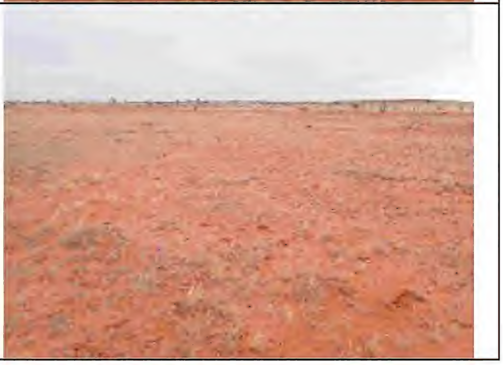
Census stop 4	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

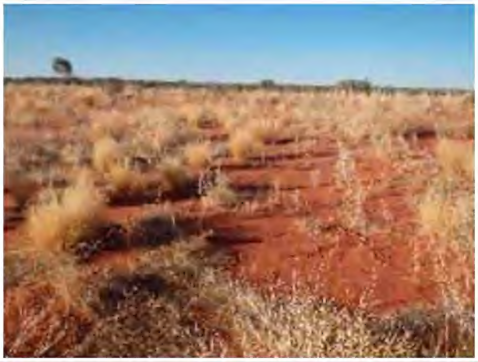
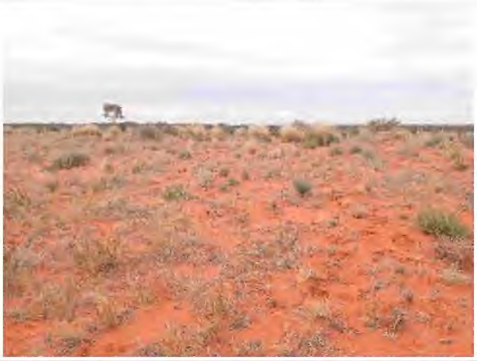
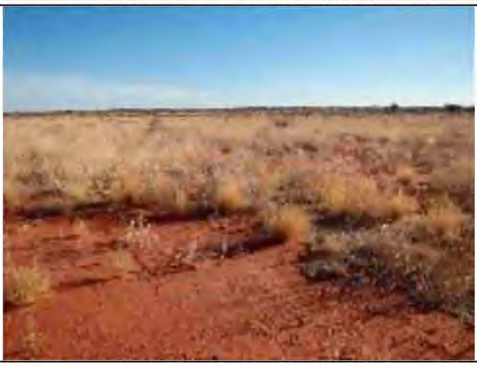
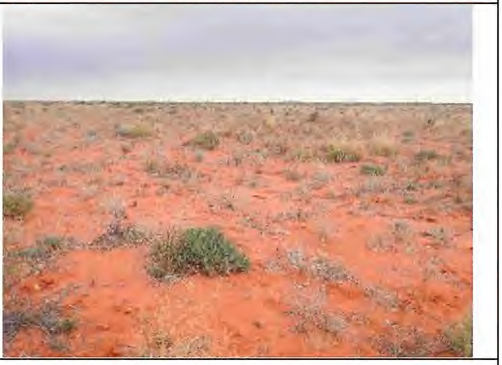
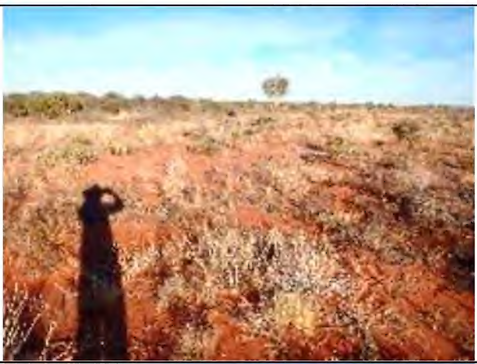
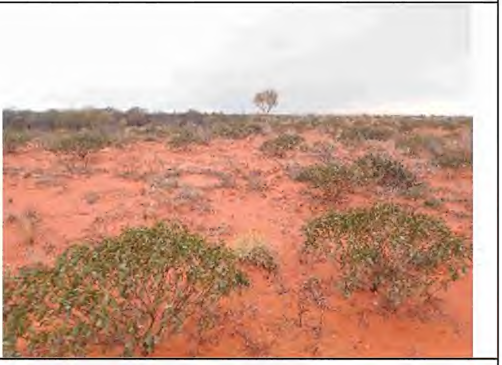
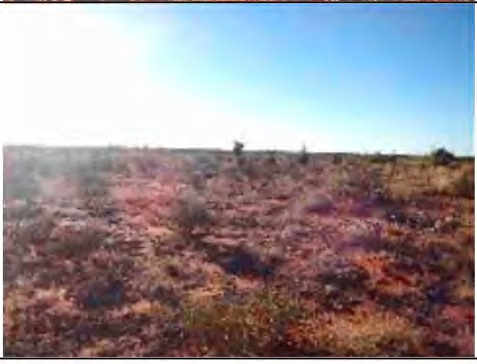
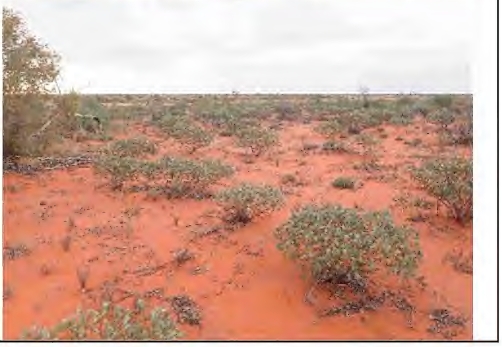
Census stop 4	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

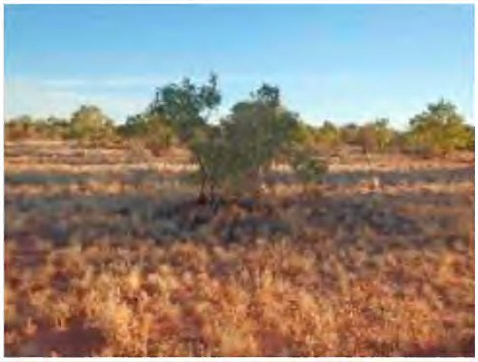
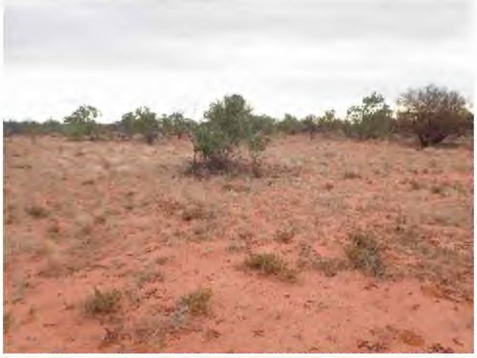
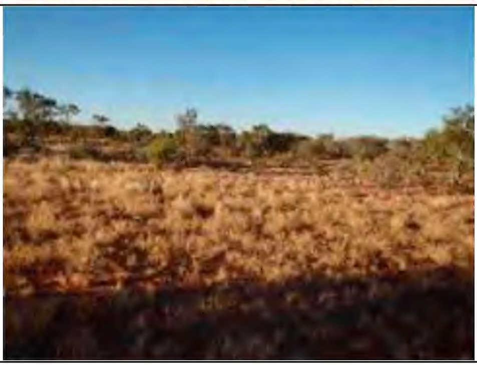
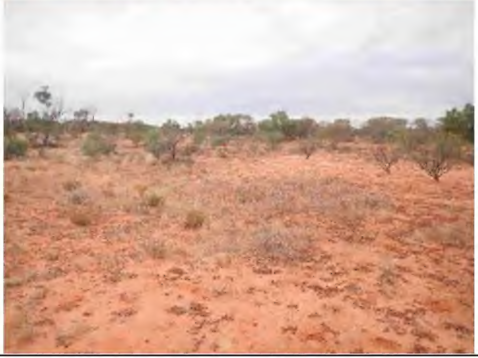
Census stop 4	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

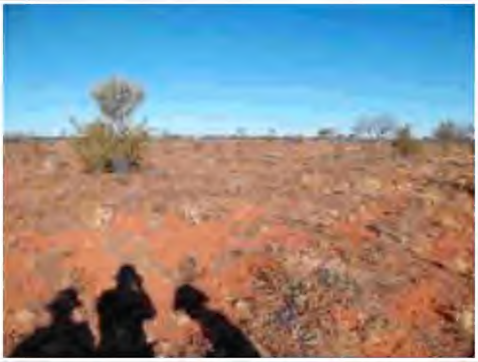
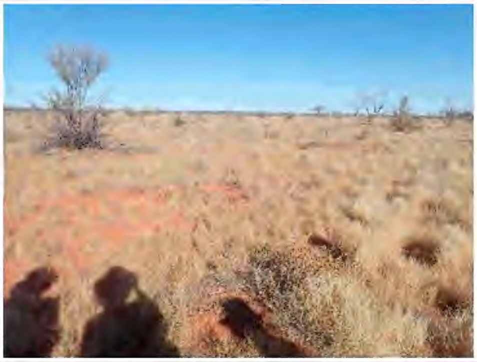
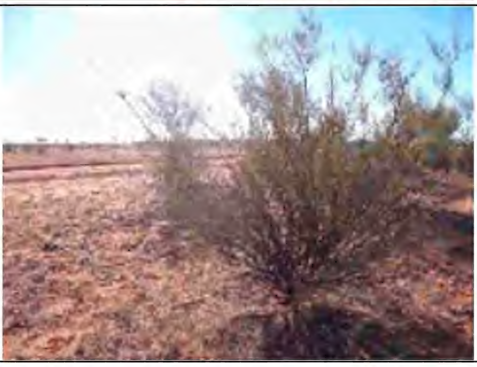
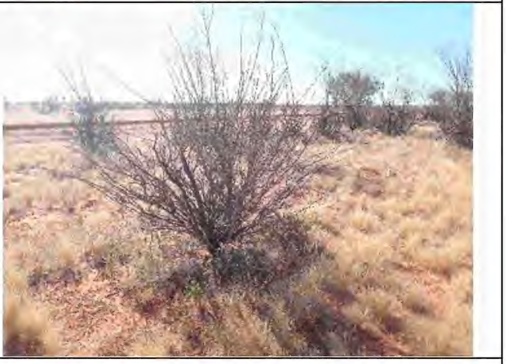
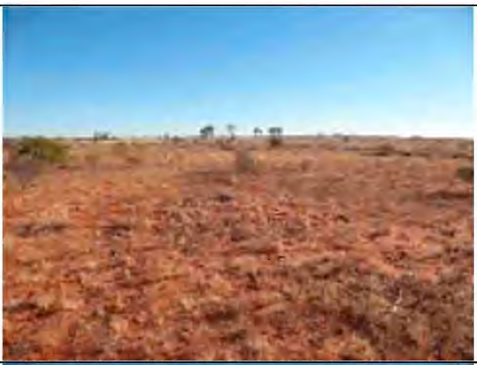
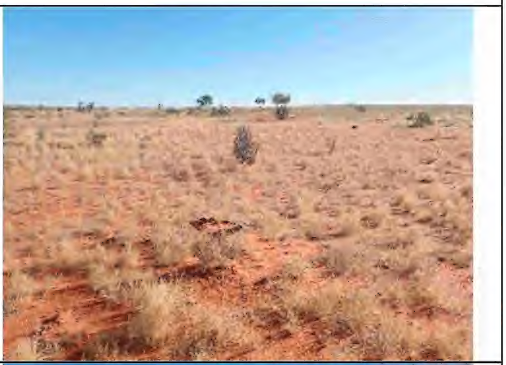
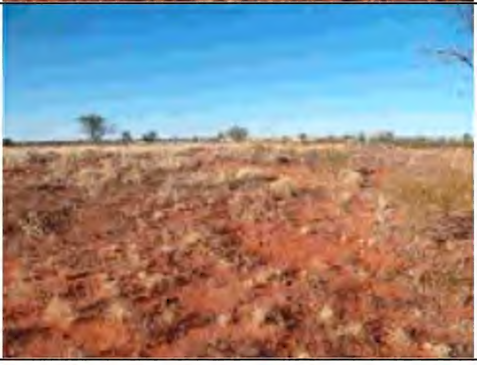
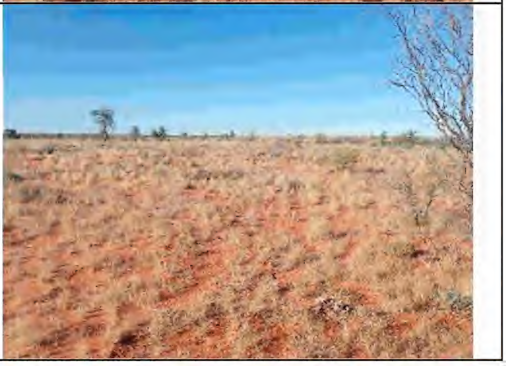
Census stop 4	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

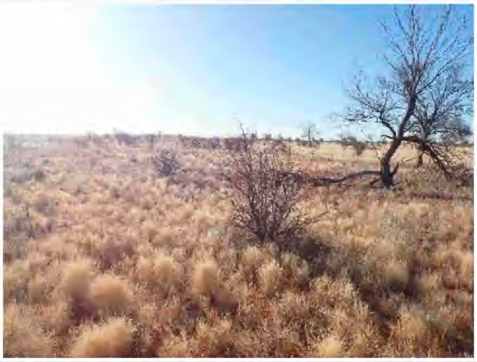
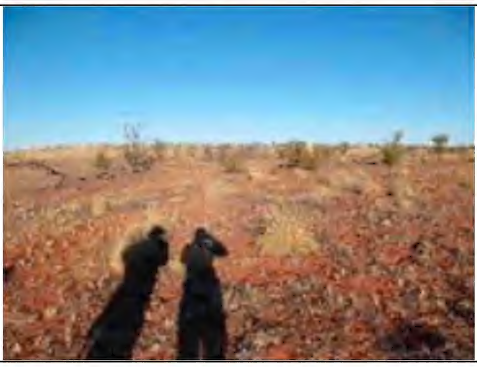
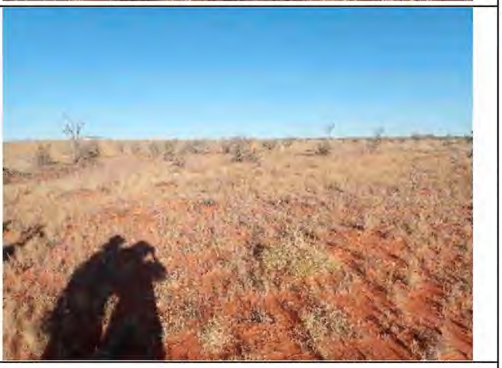
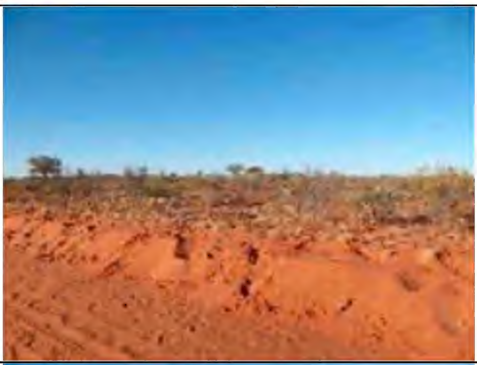
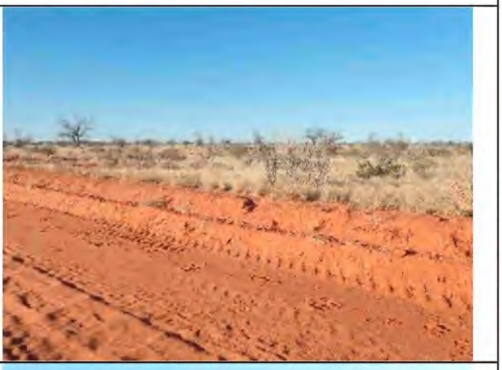
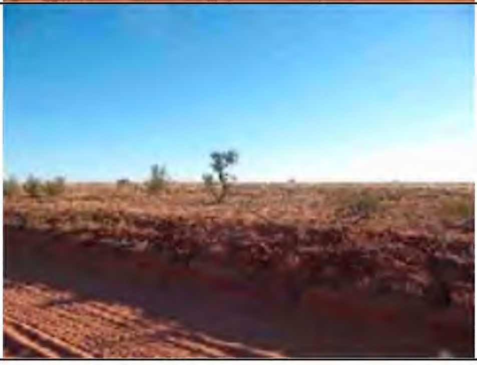
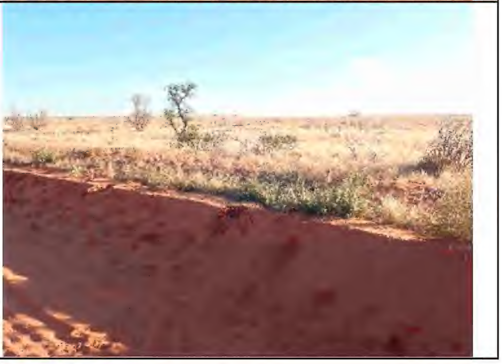
Census stop 5	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

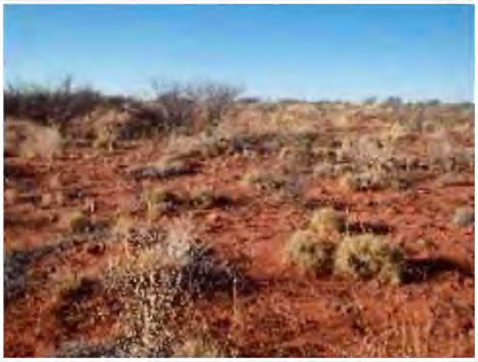
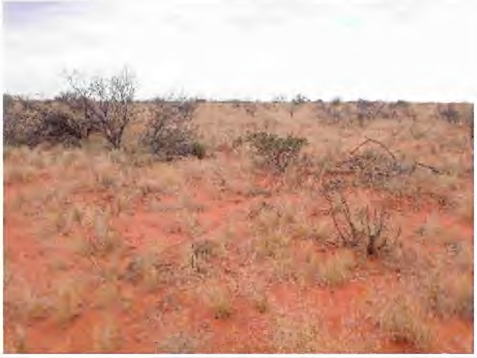
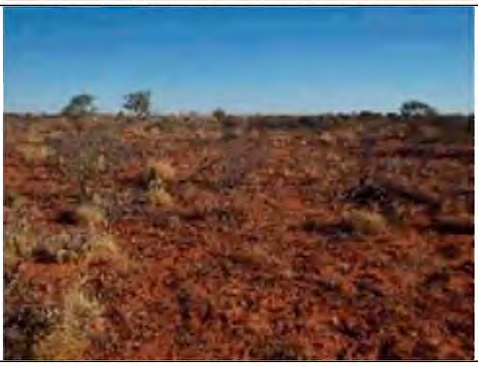
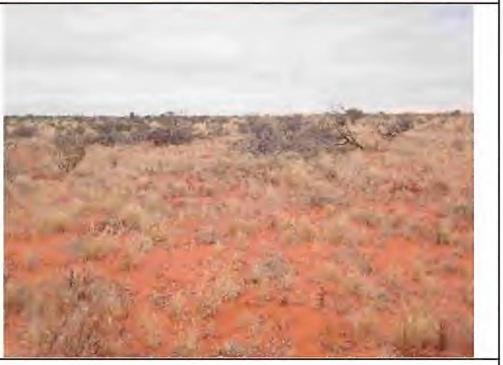
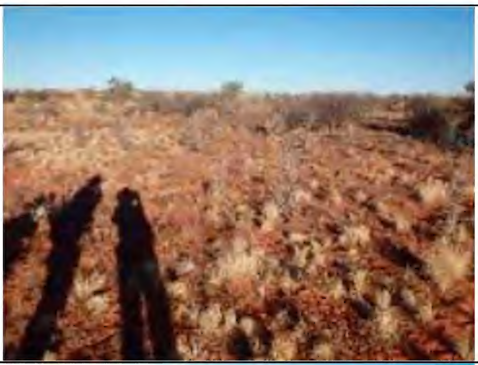
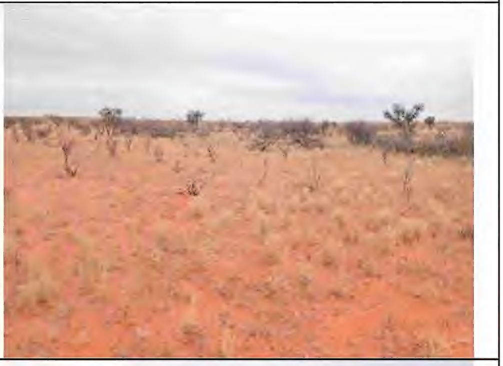
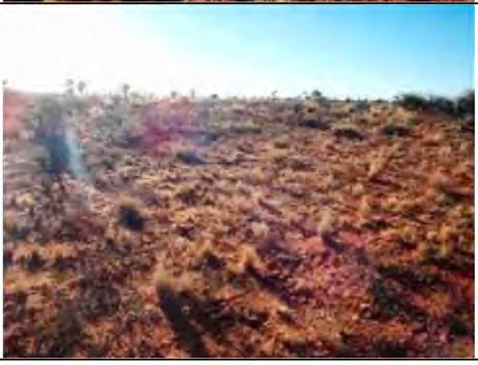
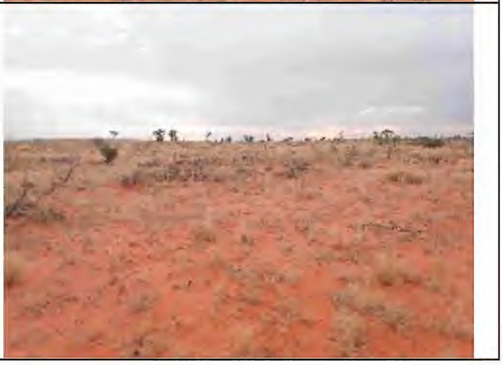
Census stop 5	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 5	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 5	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 6	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 6	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 6	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 6	**2017**	**2022**
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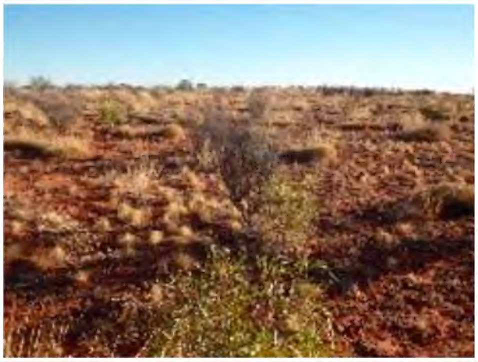
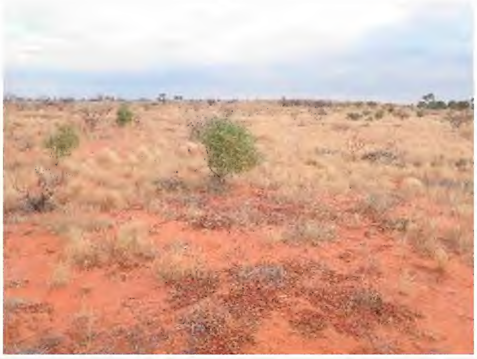
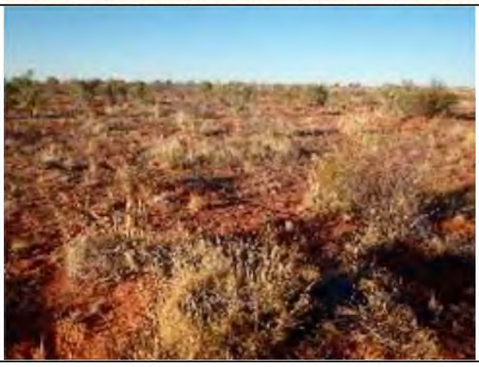
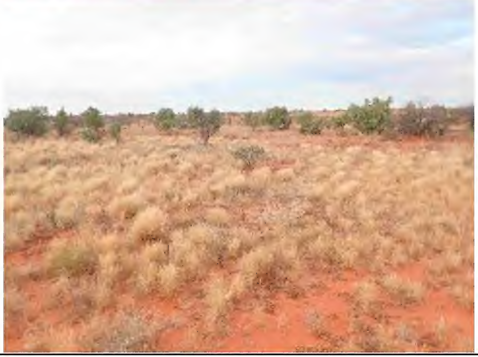
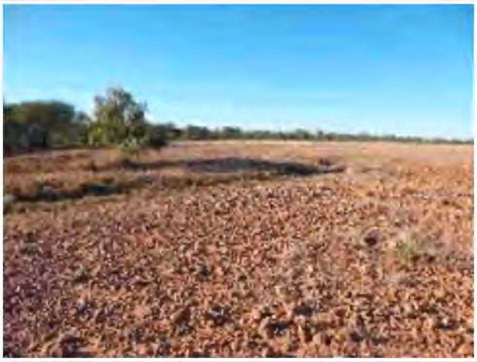
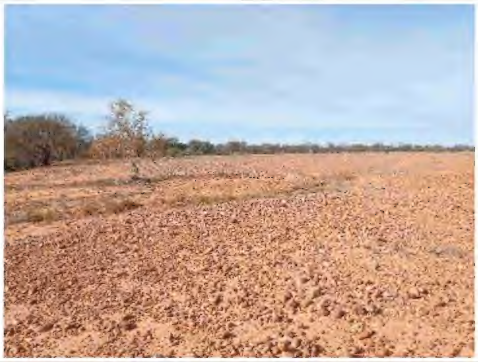
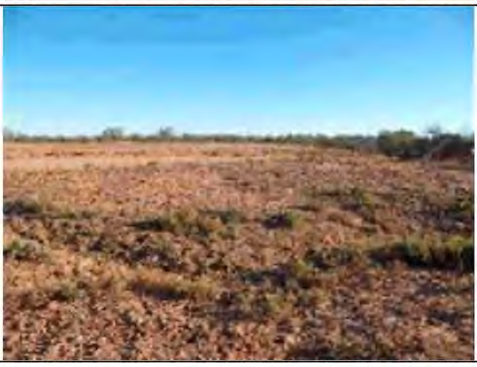
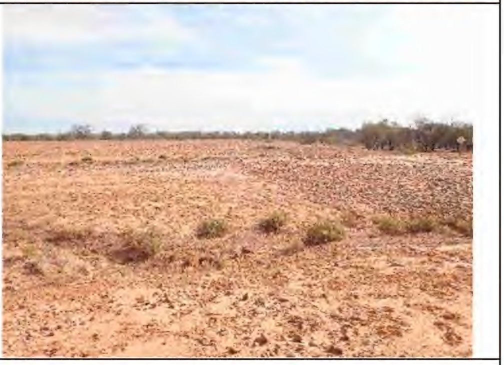
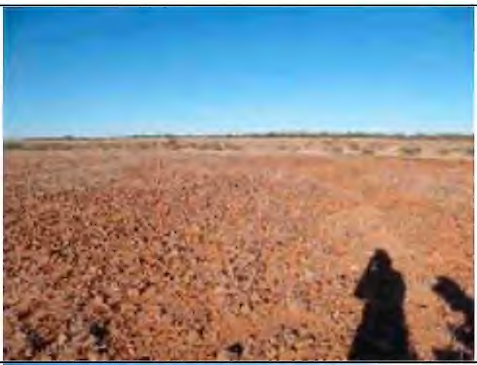
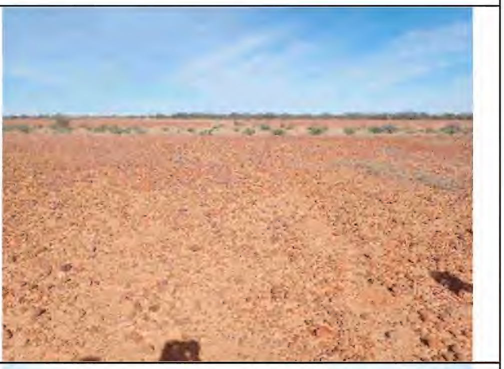
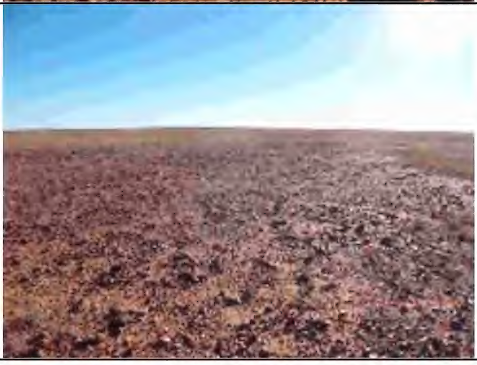
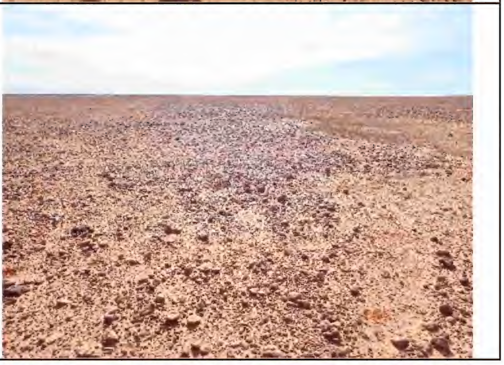
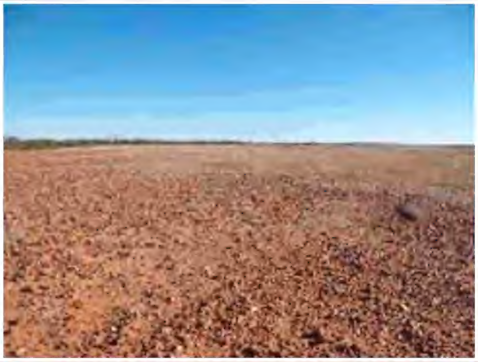
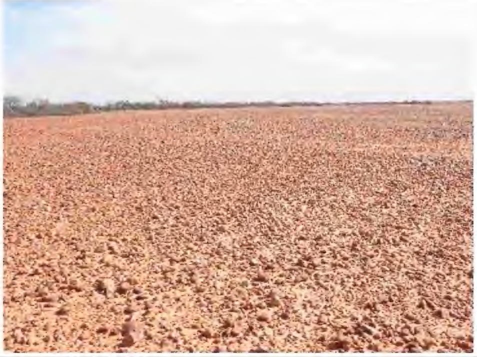
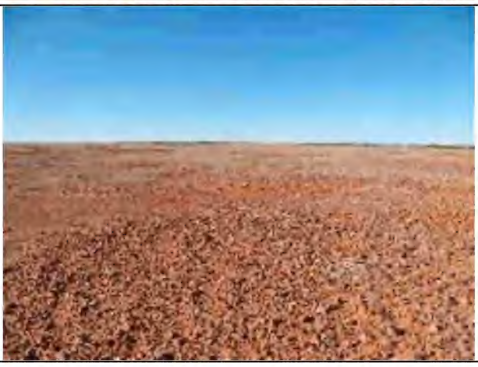
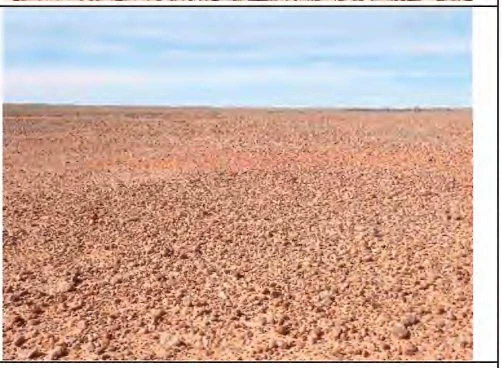
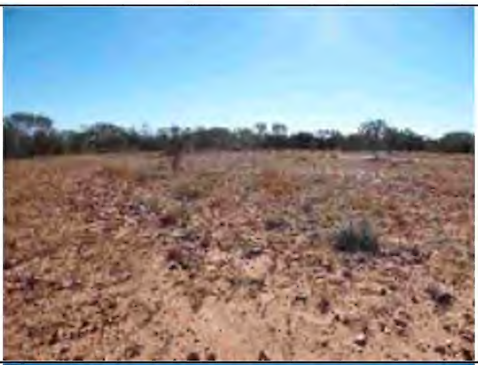
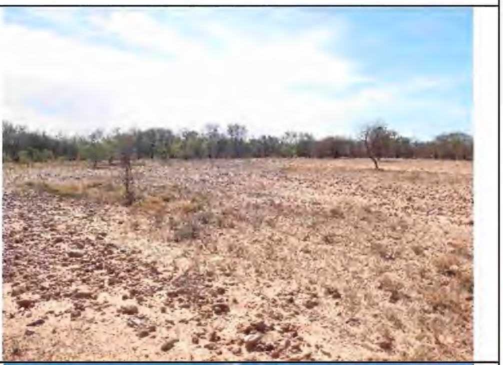
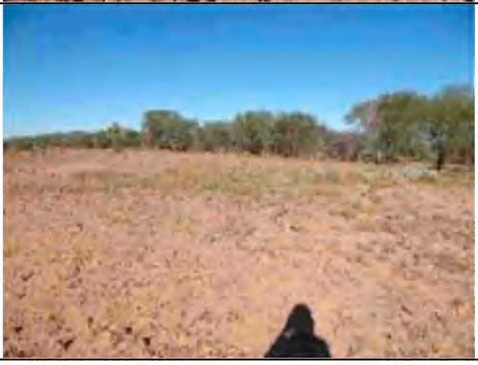
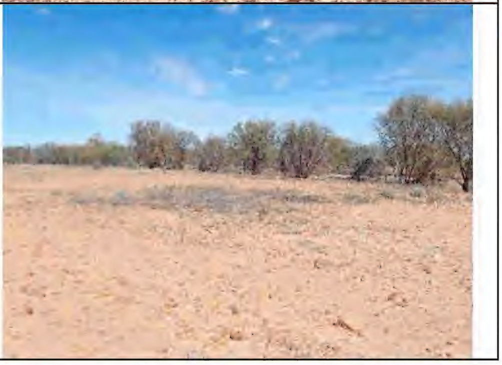
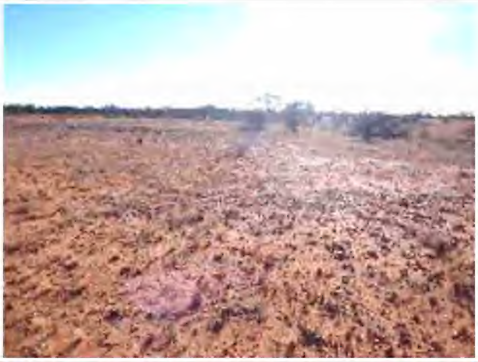
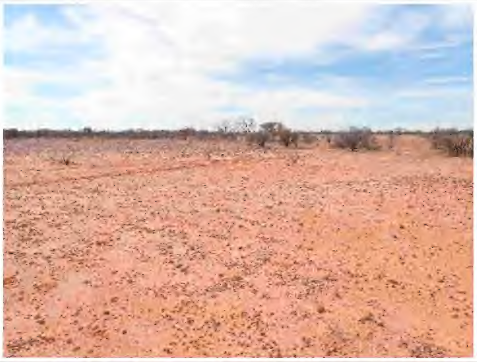
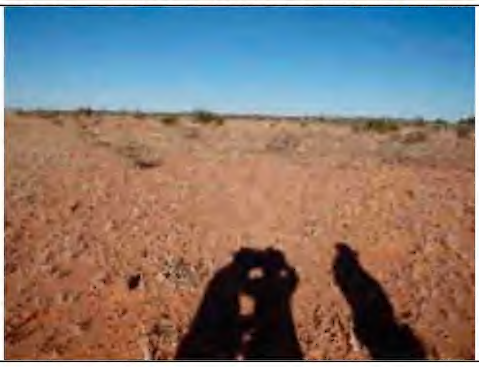
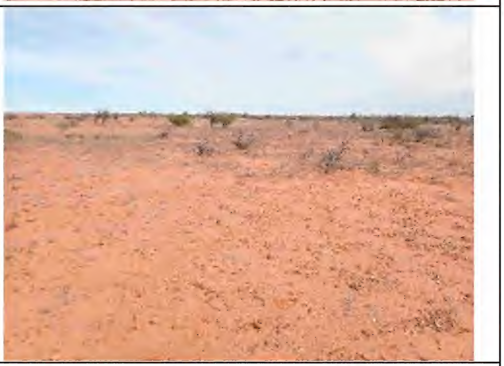
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 7	**2017**	**2022**
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 7	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 7	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
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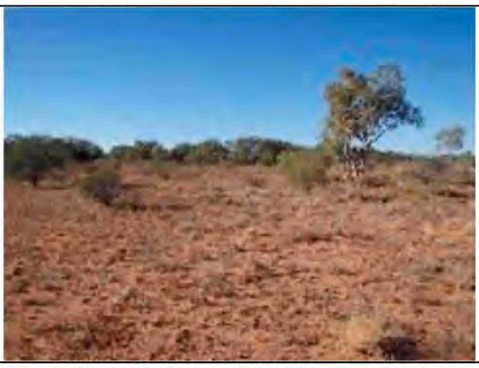
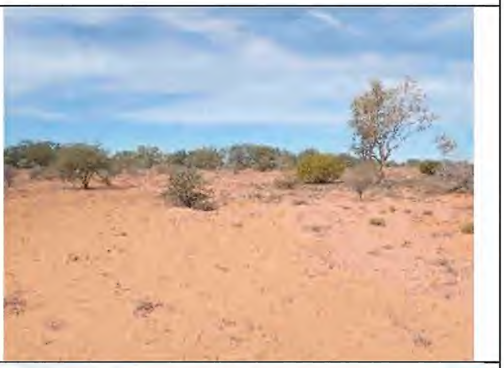
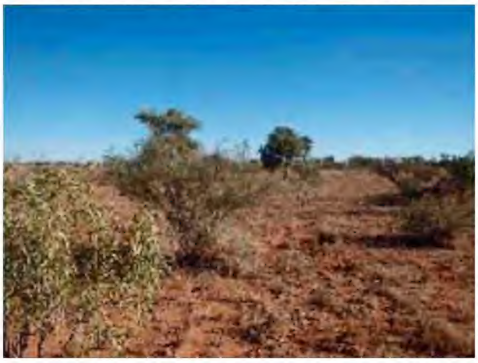
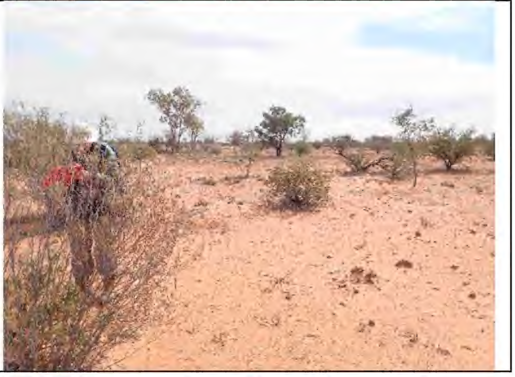
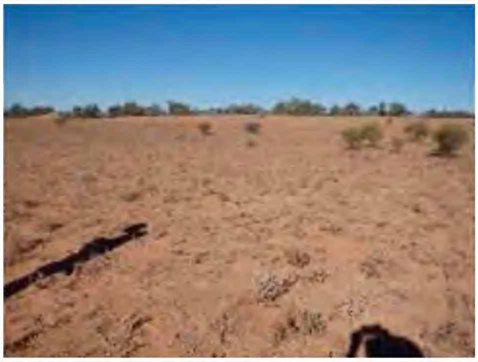
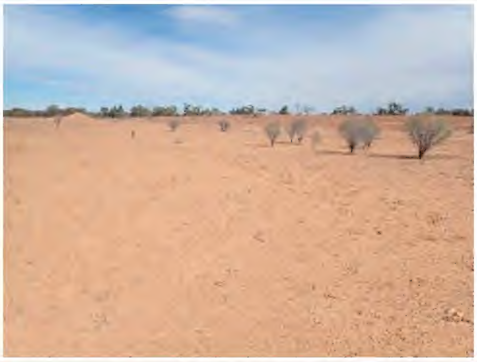
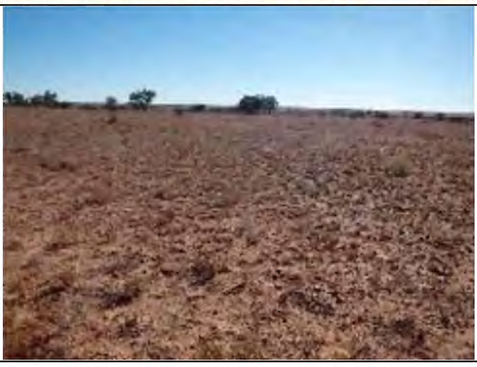
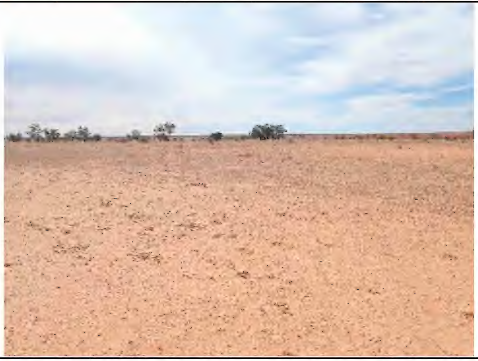
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 7	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 8	**2017**	**2022**
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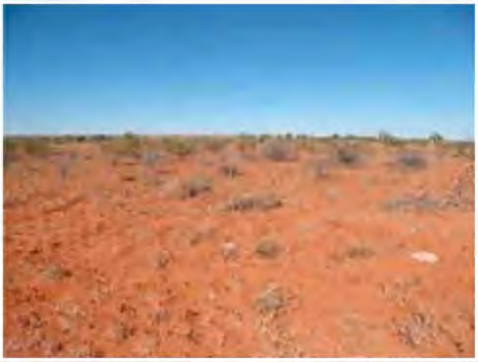
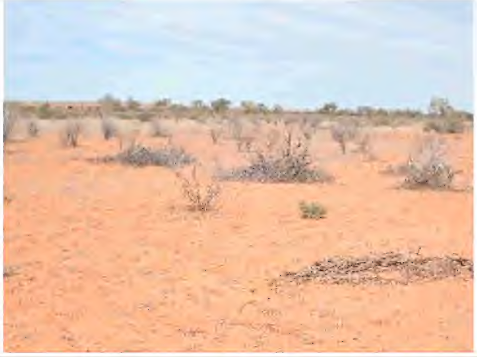
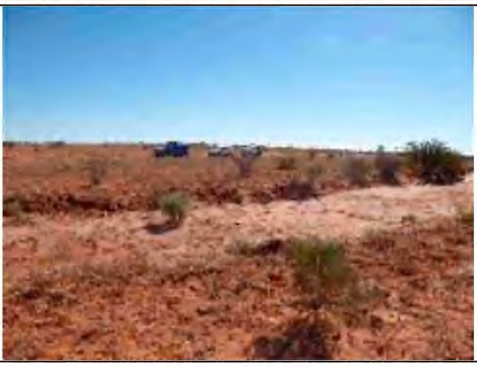
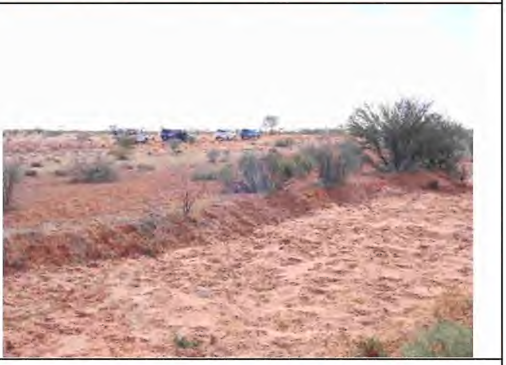
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
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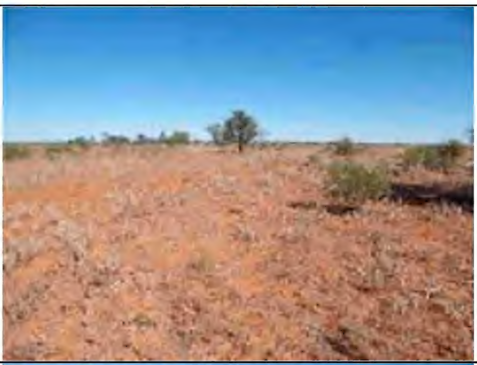
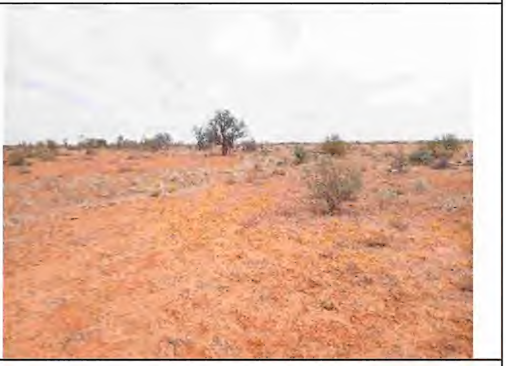
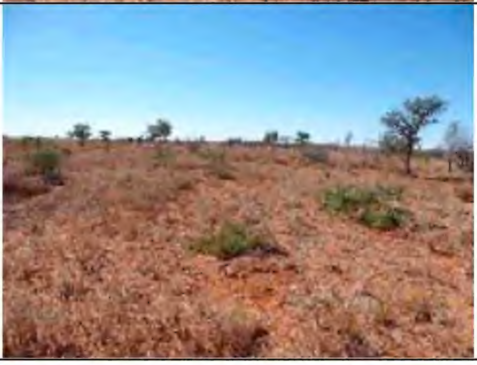
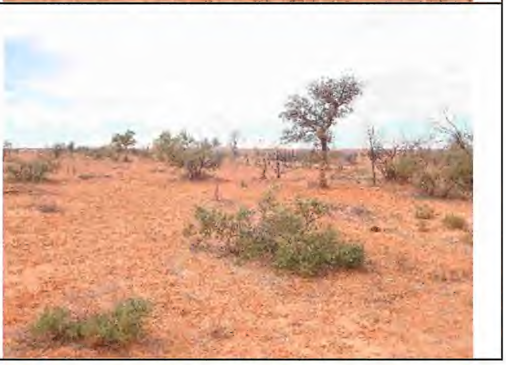
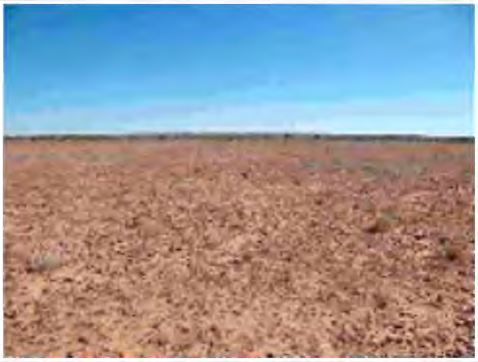
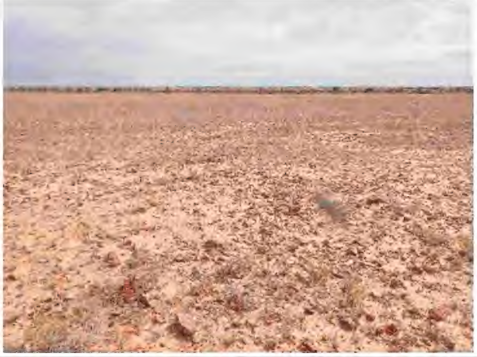
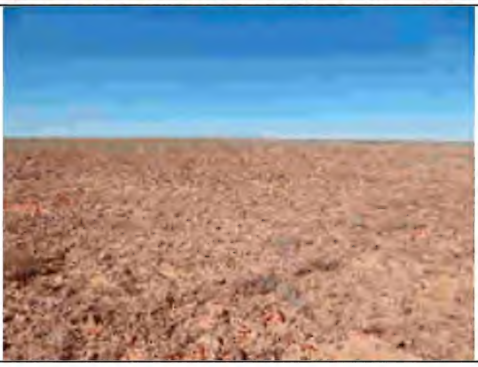
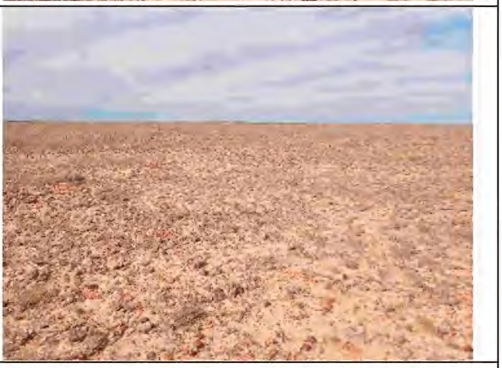
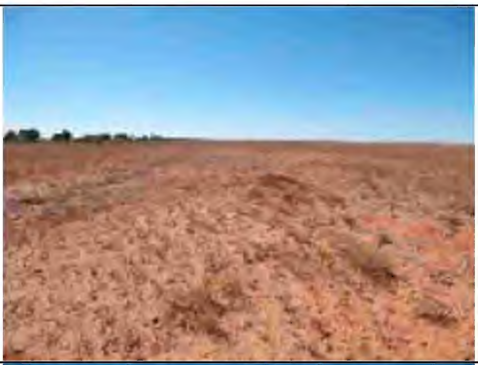
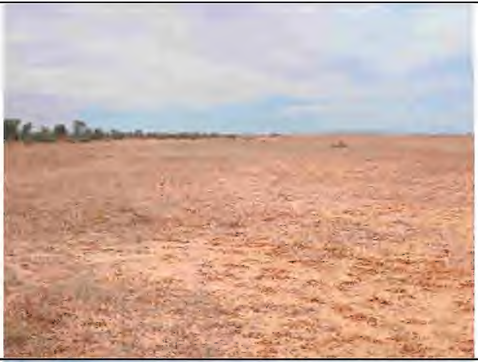
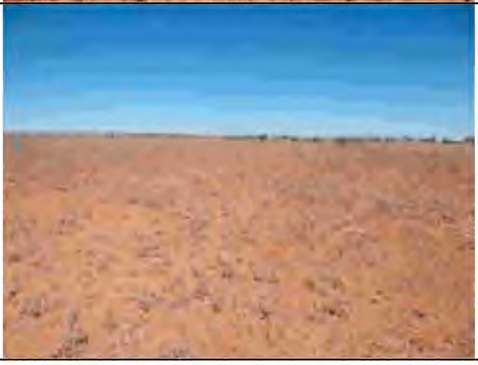
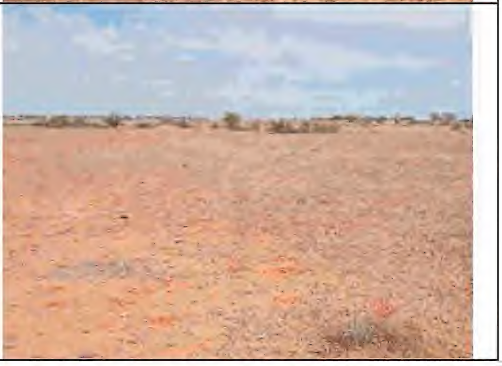
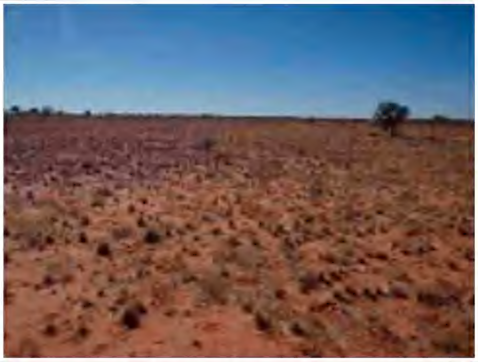
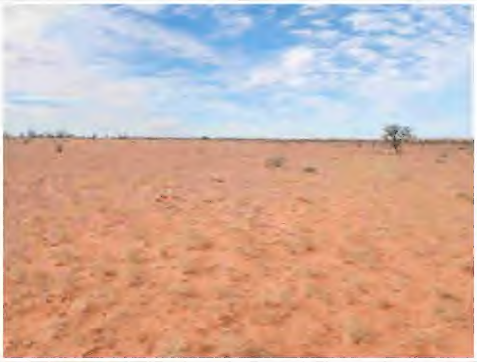
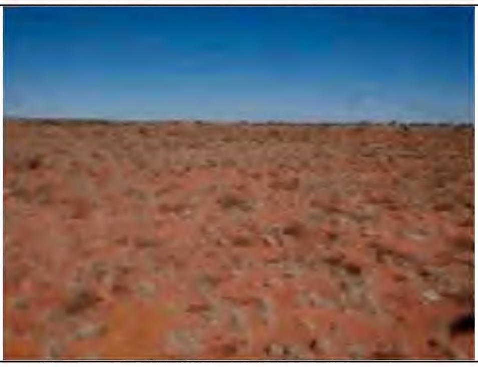
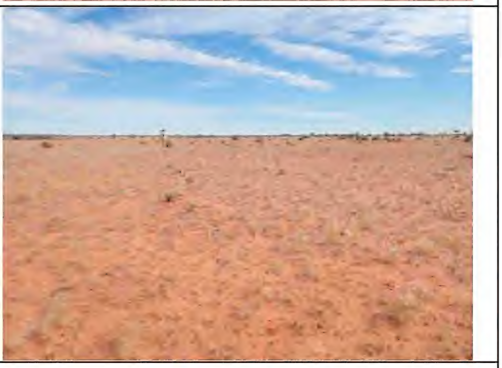
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 8	**2017**	**2022**
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 8	**2017**	**2022**
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
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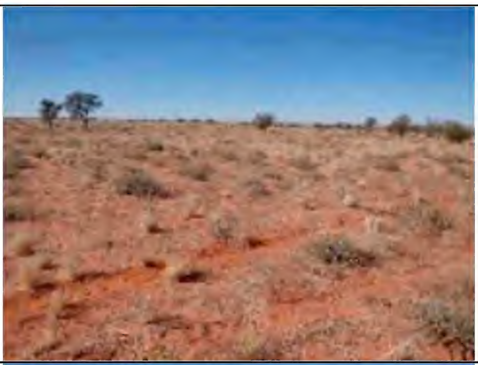
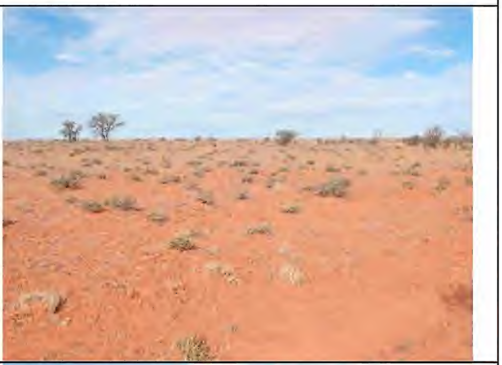
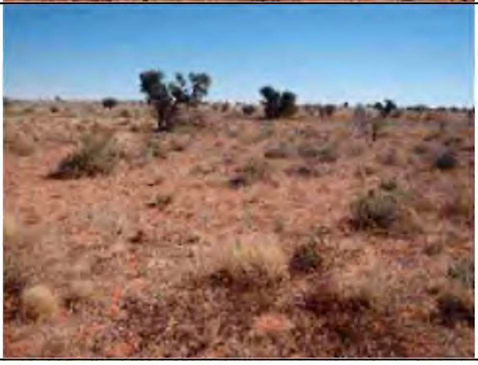
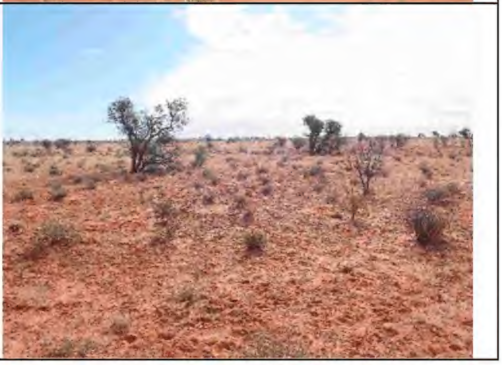
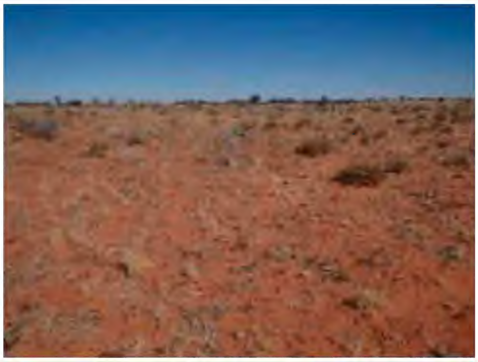
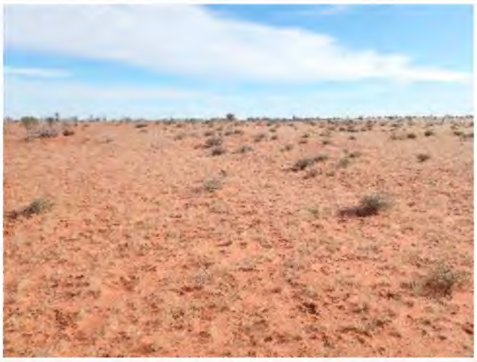
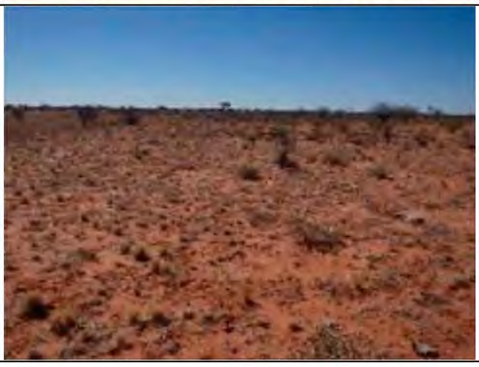
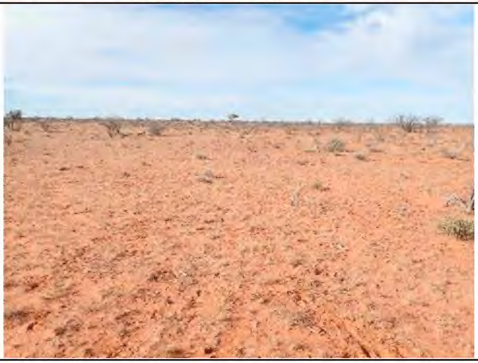
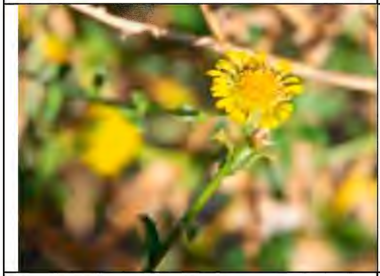
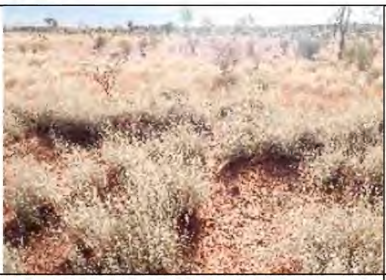
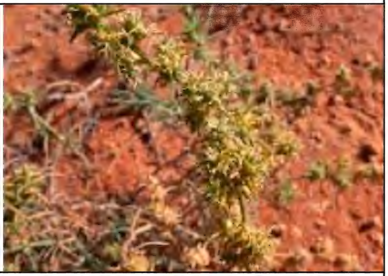
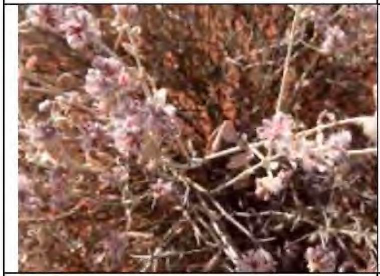
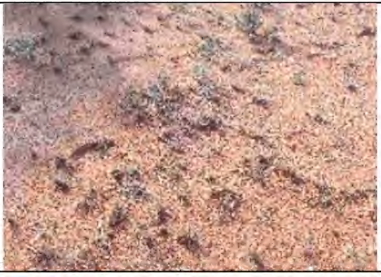
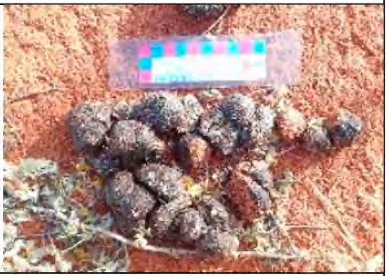
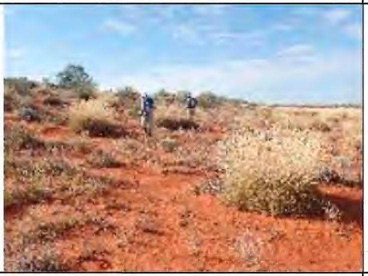
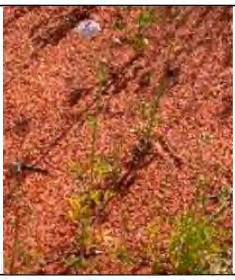
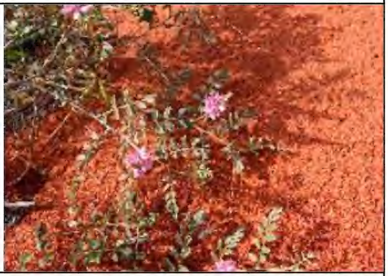
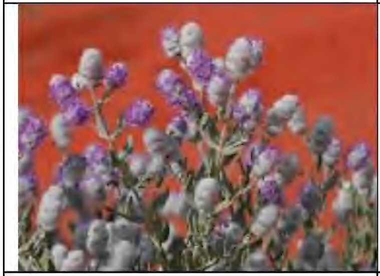
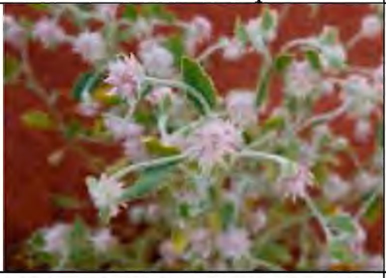
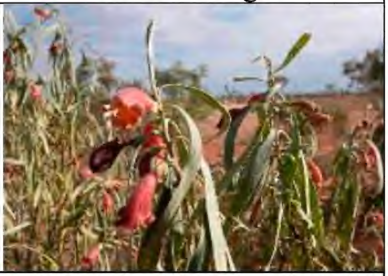
Right (to centre of western quadrant)		
Left (away from western quadrant)		

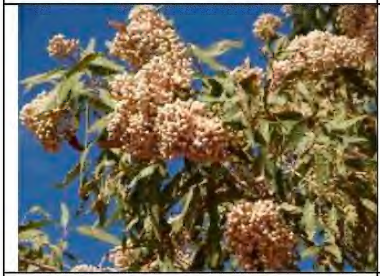
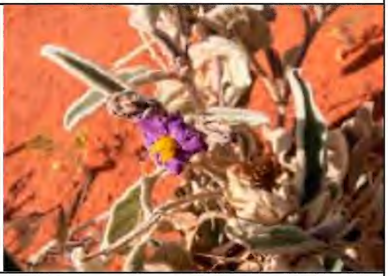
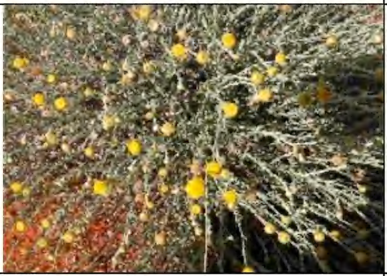
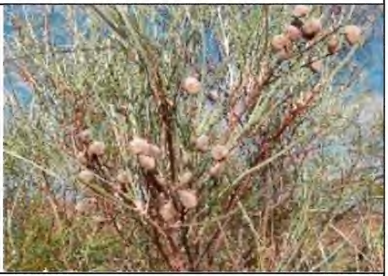
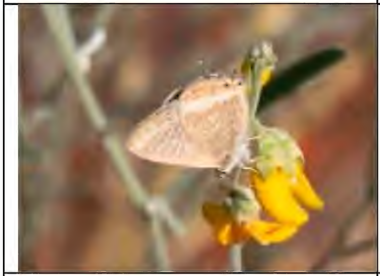
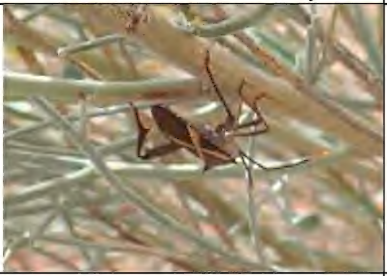
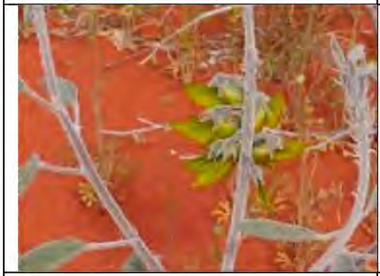
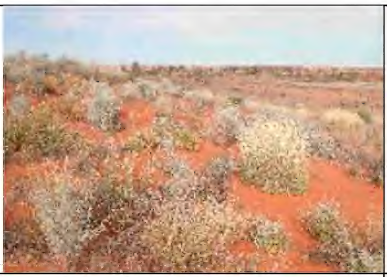
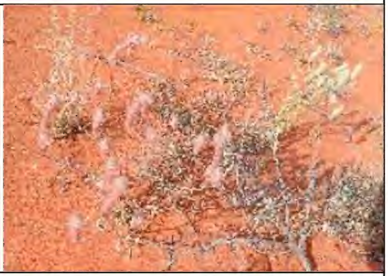
Census stop 8	**2017**	**2022**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

APPENDIX IV - PHOTOGRAPHIC AND HABITAT RECORDS

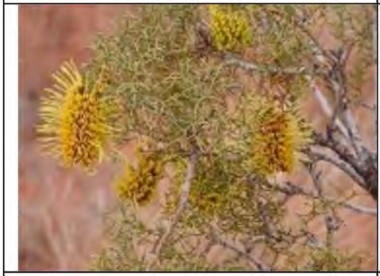
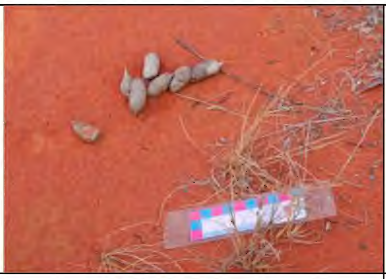
Original photographs are available from FOIR for analysis if required.

Census stop: CR01 Date: 03/08/2022 Start time: 08:45
Weather: 22ºC. 20% high cloud, moderate wind.
Number of observers: 4
Habitat: Sand plain between well-spaced dunes. Tussock grassland with open shrubs and woodland.

Transect A	Habitat: Tussock grassland 75% cover, open shrubs on dune.	
		
Calotis erinacea	Tussock grassland on sand plain	*Salsola australis* Australian Tumbleweed
		
Ptilotus obovatus, Cotton Bush	Camel tracks	Camel scats
		
Dune vegetation	*Trachymene glaucifolia,* Wild Parsnip	*Indigofera brevidens,* Desert Indigo
		
Newcastelia cephalantha	*Ptilotus latifolius*, Tangled Mulla Mulla	*Eremophila longifolia,* Weeping Emubush

Transect B	Habitat: Sand plain tussock grassland. Open shrubs on dune.	
		
Corymbia terminalis, Desert Bloodwood	*Rostellularia sp.*	*Solanum lithophilum*
		
Setaria reflexa	*Leiocarpa leptolepis,* Stalked Plover-Daisy	*Grevillea stenobotrya,* Sandhill Spider-Flower
		
Lampides boeticus, Long-tailed Pea-Blue	*Mictis profana,* Crusader Bug	
Transect C	Habitat:	
		
Crotalaria cunninghamii, Bird flower	Shrubs on sand dune	*Ptilotus polystachyus*, Prince of Wales Feather
Transect D	Habitat: Sand plain tussock grassland. Open shrubs on dune.	
Spider hole showing trapdoor	Termite colony on tussock grass	*Cenchrus ciliaris,* Buffelgrass on dune

Mixed shrubs and grasses on dune		
Transect E	Habitat: Sand plain tussock grassland. Open shrubs on dune.	
Iridomyrmex sp. Rainbow Ants on *Hakea*	*Corymbia terminalis,* Bloodwood	*Portulaca oleracea,* Pigweed
Calandrinia balonensis, Parakeelya		
Transect F	Habitat: Sand dune with open shrubs.	
Acacia ligulata, Dune Wattle	*Hadrorhinus collaris* on *Crotalaria eremaea*	*Calandrinia sp.*
Transect G	Habitat: Sand plain with tussock grasses. Scattered shrubs and Bloodwood.	
Open woodland	*Capparis mitchellii,* Bumble Tree	*Swainsona sp.*

<table>
<tr><td> </td><td></td><td></td></tr>
<tr><td>Termite mound</td><td></td><td></td></tr>
<tr><td>Transect H</td><td colspan="2">Habitat: Sand plain with tussock grasses. Occasional shrubs.</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>*Hakea eyreana,* Straggly Corkbark</td><td>Snake scat?</td><td></td></tr>
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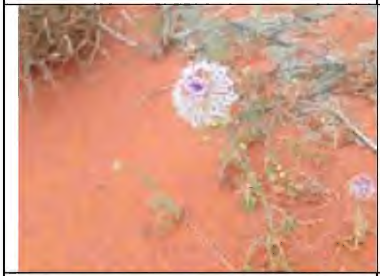
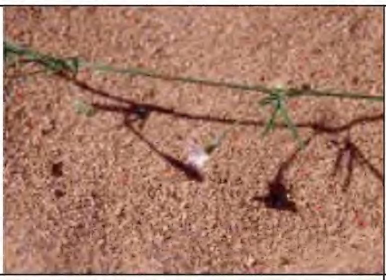
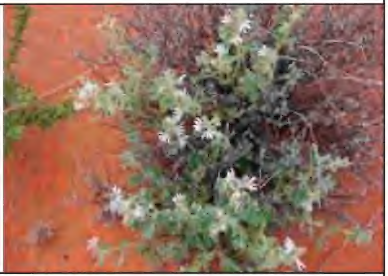
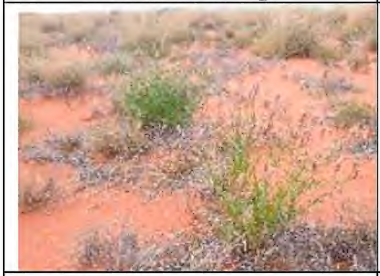
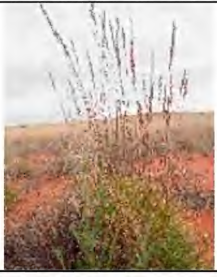
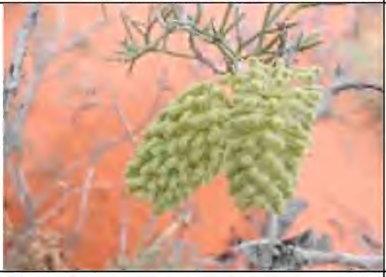
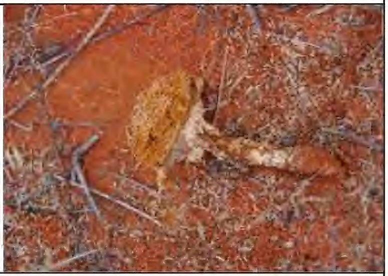
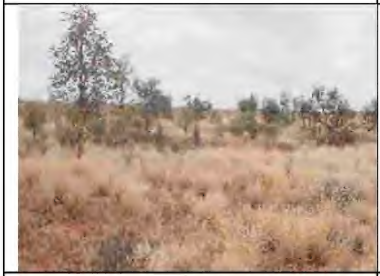
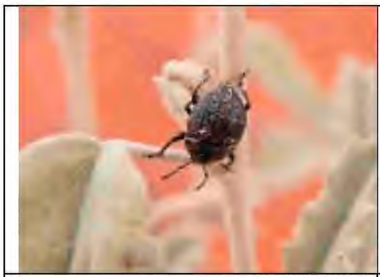
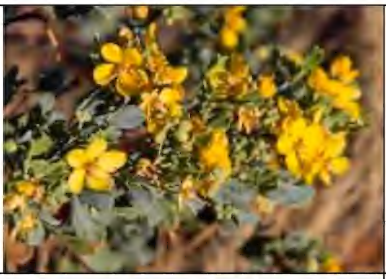
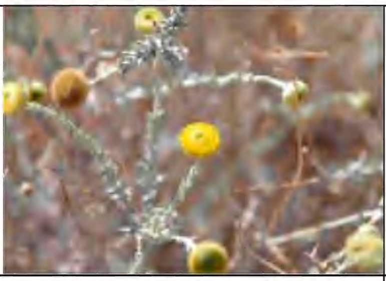
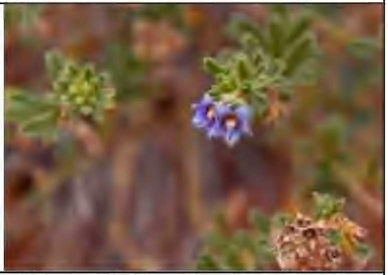
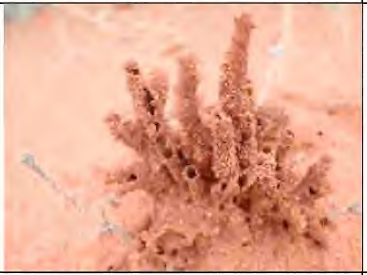
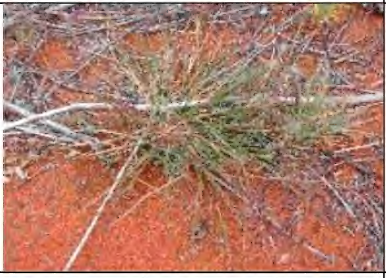
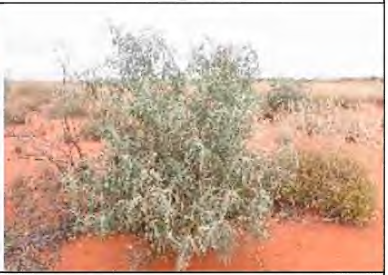
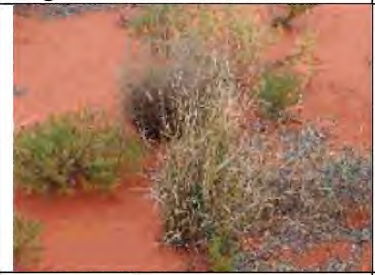
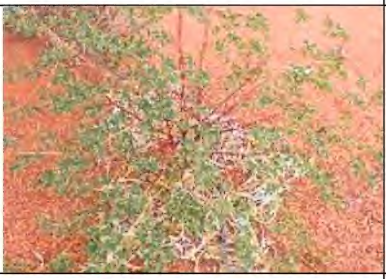
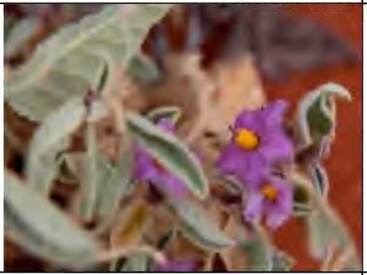
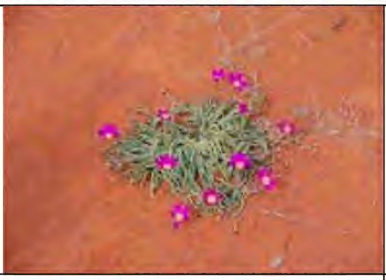
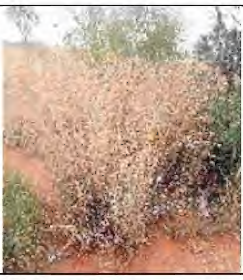
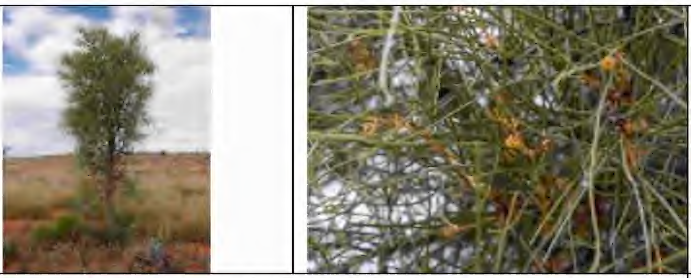
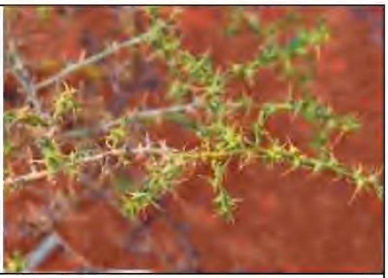
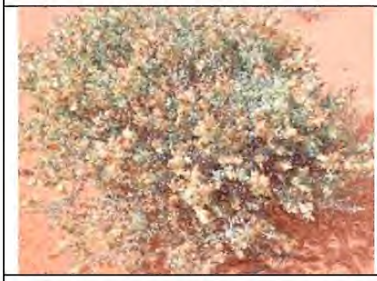
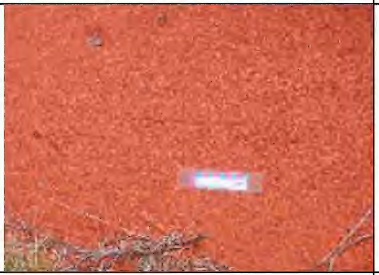
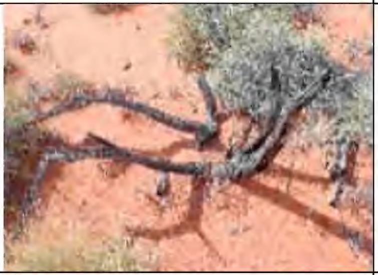
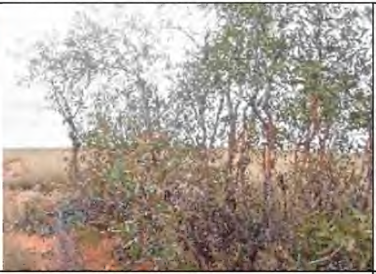
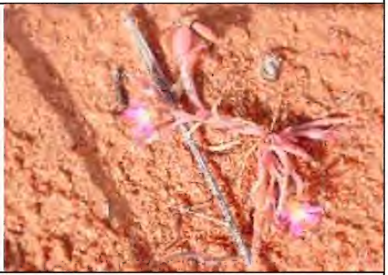
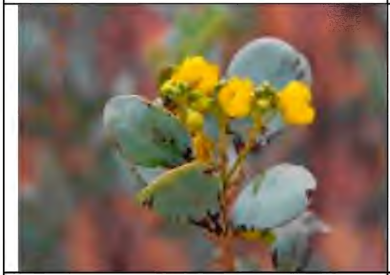
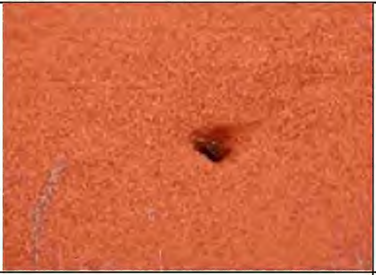
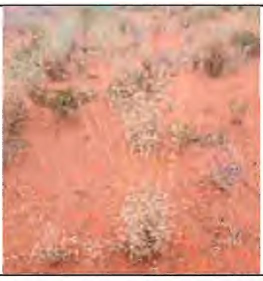
Census stop: CR02 Date: 31/07/2022 Start time: 09:40
Weather: 16°C. 100% cloud, moderate wind.
Number of observers: 4
Habitat: Sand plain between with small dunes.

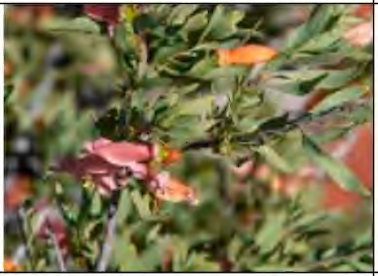
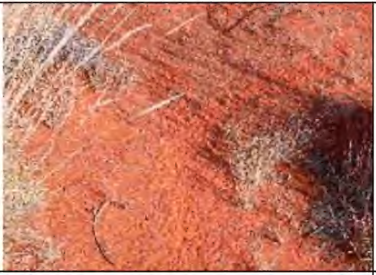
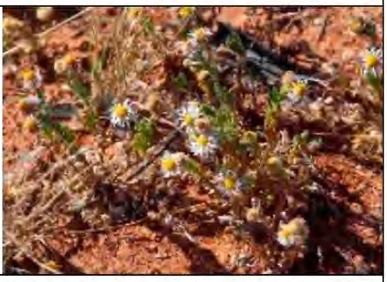
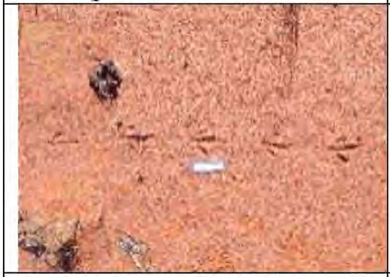
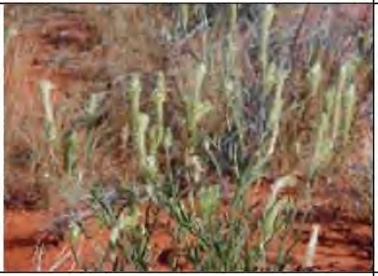
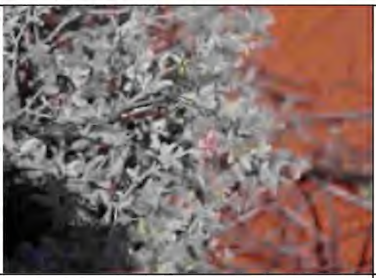
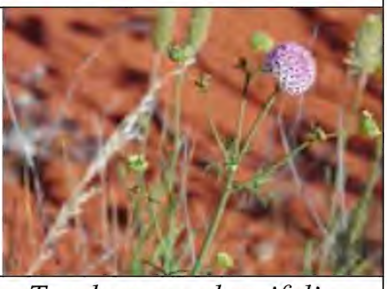
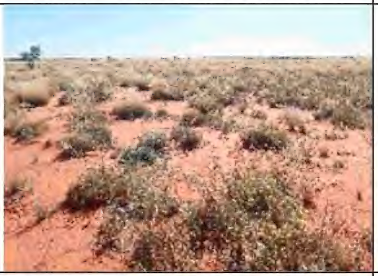
Transect A	Habitat: Triodia/tussock grassland. Approx 50% plant cover	
		
Trachymene glaucifolia, Wild Parsnip	*Convolvulus angustissimus,* Blushing Bindweed	*Scaevola parvibarbata,* Small-beard Fanflower
		
Ptilotus polystachyus, Prince of Wales Feather	*Triodia basedowii,* Buck Spinifex in seed	Small animal tracks
		
Termite mound at base of *Triodia*.	*Hakea eyreana,* Straggly Corkbark	
Transect B	Habitat: Low dune. 50% ground cover, mainly Triodia	
		
Ants nest with grass seed husks.	Tussock grass	*Battarrea phalloides,* Sandy Stilt-Puffball

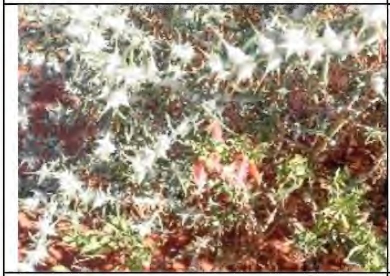
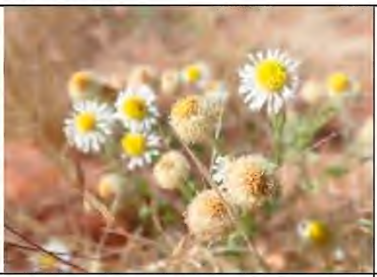
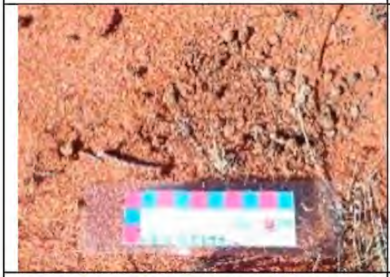
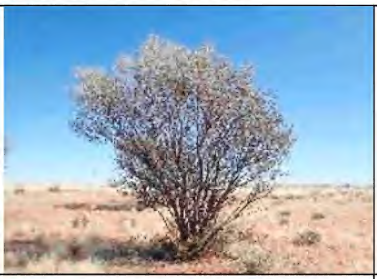
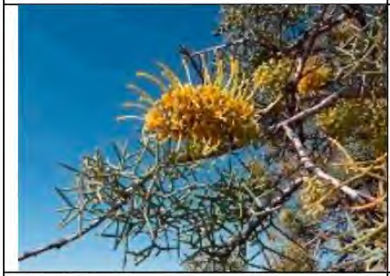
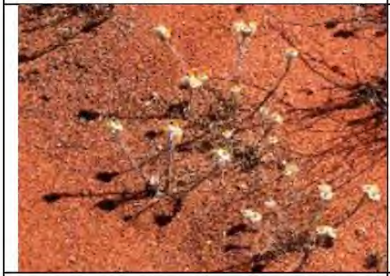
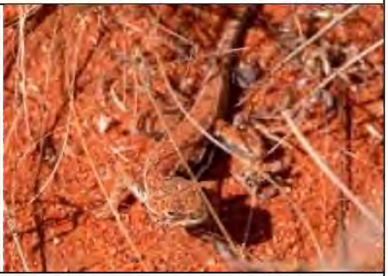
Magpie or corvid pellet.	*Ptilotus sessilifolius*	*Scaevola depauperata,* Skeleton Fan-Flower
Halgania cyanea, Rough Halgania	Bee fly on *Newcastelia cephalantha*	*Crotalaria eremaea,* Bluebush Pea
Calandrinia balonensis, Parakeelya	*Cenchrus ciliaris,* Buffel Grass	*Coccinella transversalis,* Transverse Ladybird Beetle
Transect C	Habitat: Sand plain tussock grassland, 50% cover	
		
Typical habitat with scattered shrubs.	*Rhytidoponera sp.*	*Euphorbia sp.*
Transect D	Habitat: Sand plain tussock grassland, 50% cover	
Solanum sp.	Drifts of grass seeds	*Podaxis pistillaris,* Desert Shaggymane

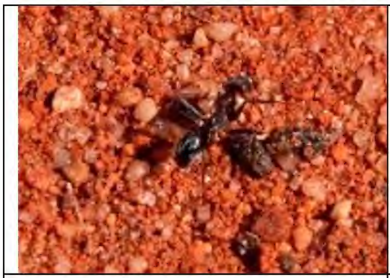
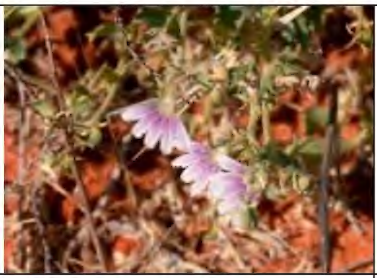
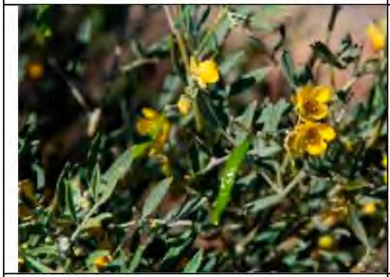
		
Hadrorhinus collaris	*Senna artemisioides, ssp. oligophylla*	Evidence of past fires
Transect E	Habitat: Triodia/tussock grassland. Approx 50% plant cover	
		
Camel tracks	*Leiocarpa leptolepis,* Stalked Plover-Daisy	*Halgania cyanea,* Rough Halgania
		
Termite chambers built on grass, since consumed	*Eriachne aristidea*	*Eremophila longifolia,* Weeping Emubush
		
Paraneurachne muelleri	*Euphorbia sp.*	
Transect F	Habitat: Triodia/tussock grassland. Approx 90% plant cover	
		
Solanum sp.	*Calandrinia balonensis,* Parakeelya	*Poaceae*

		
Acacia sericophylla, Cork-Bark Wattle		*Sclerolaena*
		
Maireana sp.	Bird tracks	
Transect G	Habitat: Triodia/tussock grassland. Approx 40% plant cover. Burnt in the past	
		
Shrubs destroyed by fire.	*Atalaya hemiglauca*, Cattle Bush regeneration	*Calandrinia sp.*
		
Senna sp.		
Transect H	Habitat: Shrubby tussock grassland with *Senna* & *Acacia spp*.	
		
Button quail or Diamond Dove 'platelets'	Small mammal pophole.	*Aristida sp.*

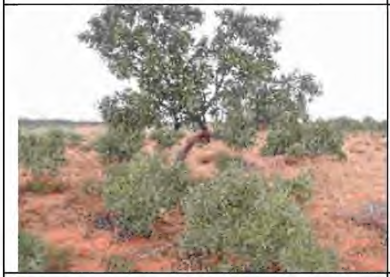
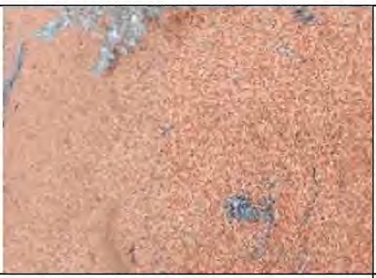
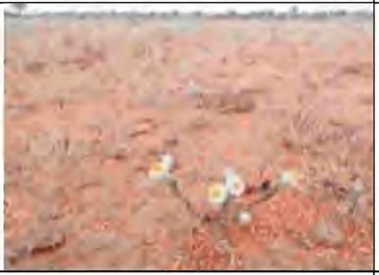
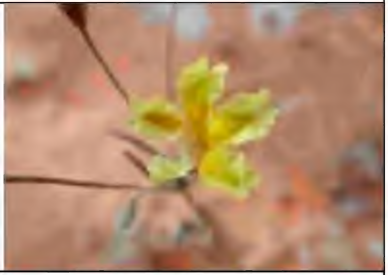
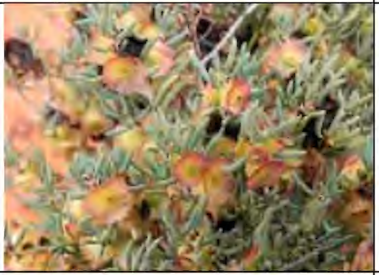
Census stop: CR03 Date: 01/08/2022 Start time: 09:10
Weather: 18°C. 0% cloud, moderate wind.
Number of observers: 4
Habitat: Sand plain between with small dunes.

Transect A	Habitat: Sand plain with tussocks and spinifex. Scattered mulga. 70% cover.	
		
Eremophila maculata, Spotted Emu Bush	Small mammal trackway	*Calotis sp.*
		
Bustard tracks		
Transect B	Habitat: Sand plain with scattered shrubs and Triodia. 50% cover.	
		
Ptilotus polystachyus, Prince of Wales Feather	*Ptilotus sessilifolius,* Crimson Foxtail	*Trachymene glaucifolia,* Wild Parsnip
		
General view of sand plain		

Transect C [redacted]	Habitat: Sand plain with scattered shrubs and Triodia. 40% cover.	
		
Sclerolaena bicornis, Flannel Burr	*Calotis sp.*	
Transect D	Habitat: Sand plain with tussock grasses and Triodia. 60% cover.	
Typical ground cover	Temite nest	
Transect E	Habitat: Sand plain with tussocks and spinifex. Scattered shrubs. 70% cover.	
		
Rabbit scats	*Acacia aneura,* Mulga	Cattle track
		
Hakea eyreana, Straggly Corkbark		
Transect F	Habitat: Low dune with Triodia and scattered shrubs. 60% cover	
		
Rhodanthe floribunda, Common White Sunray	Cattle track with many small mammal tracks.	*Ctenophorus isolepis*, Military Dragon

		
Iridomyrmex sp., Rainbow Ants		
Transect G	Habitat: Sand plain with tussock grasses. 70% cover	
		
Temite nest	*Scaevola parvibarbata,* Small-beard Fanflower	
Transect H	Habitat: Sand plain with tussock grasses. 75% cover	
		
Senna sp.		

Census stop: CR04 Date: 02/08/2022 Start time: 08:40
Weather: 16°C. 90% cloud, light wind.
Number of observers: 4
Habitat: Sand plain between with small dunes.

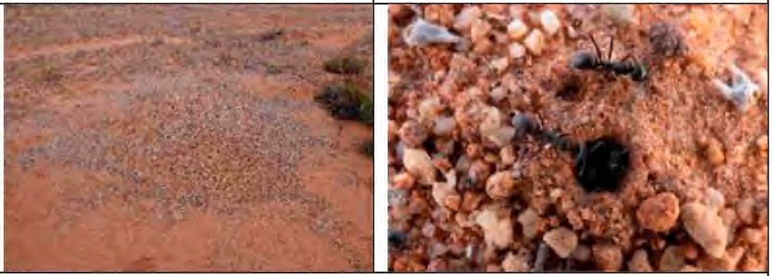
Transect A	Habitat: Sand plain with tussock grasses. 50% cover	
		
Atalaya hemiglauca, Cattle Bush regeneration	Small mammal tracks	Animal burrow
		
Sand plain vegetation	*Helichrysum sp.*	*Goodenia sp.*
Ephemeral saltbushes seeding		
Transect B	Habitat: Gibber plain, 25% vegetation cover.	
		
Maireana campanulata	Ephemeral grasses	
Transect C	Habitat: Gibber plain, sand plain and clay pan, 40% vegetation cover.	

Sand plain with low shrubs

Small mammal warren

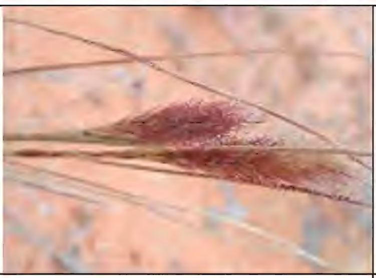
Lizard burrow

Ephemeral water course.

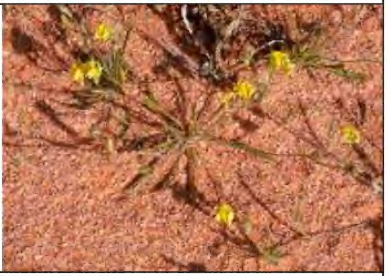


Iridomyrmex sp. harvesting seeds of *Sclerolaena bicornis.*

Seed husks covering an ant nest.



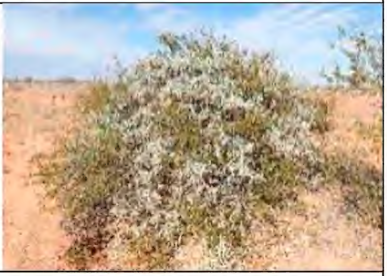
Purpleheads, *Triraphis mollis.*



Goodenia sp.

Cattle tracks on clay pan

Ephemeral herbs on clay pan

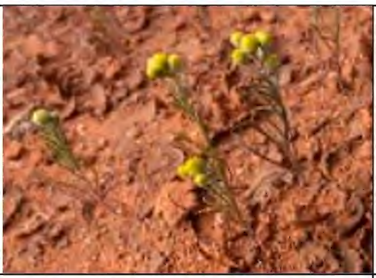


Acacia tetragonophylla and *Atriplex nummularia*

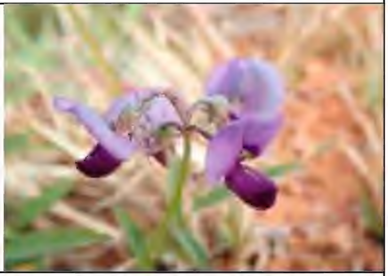
Transect D

Habitat: Sand plain with shrubs along ephemeral water channels. 50% cover.

Acacia along water channel.

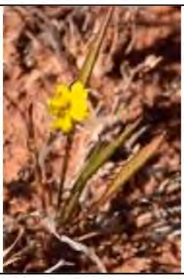
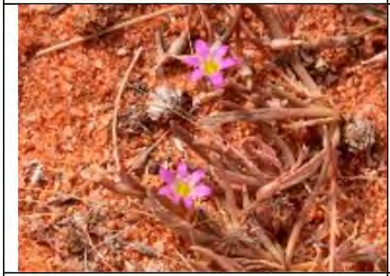
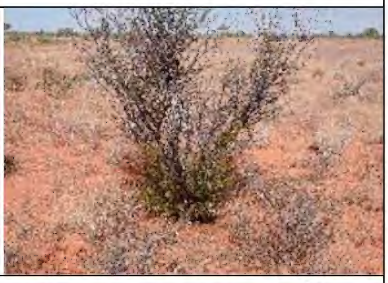


Gnephosis arachnoidea

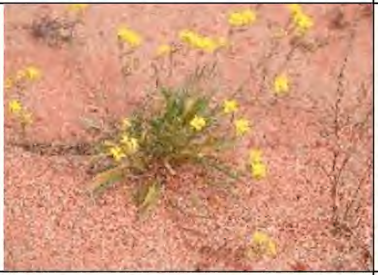
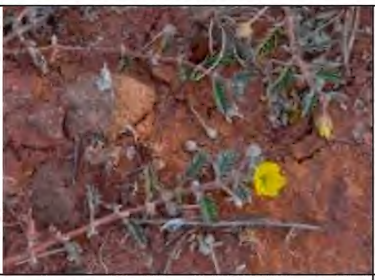
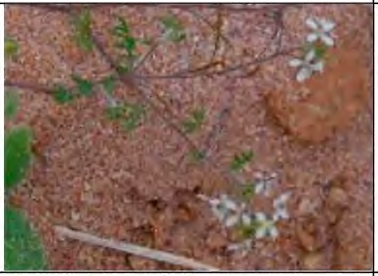
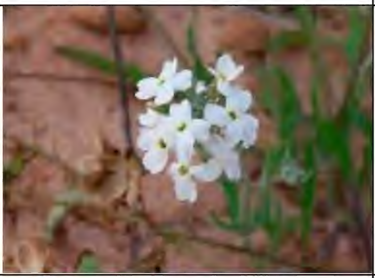
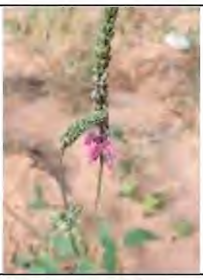
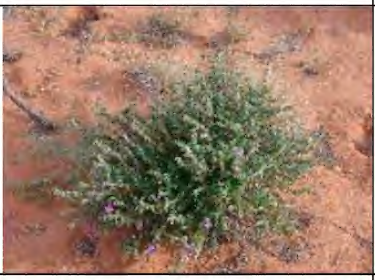
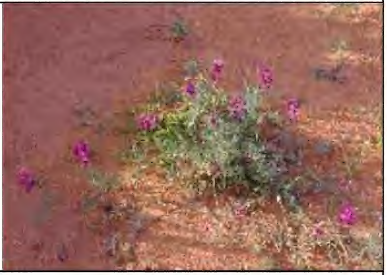
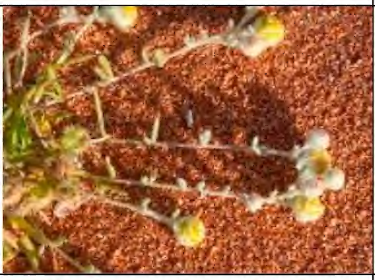
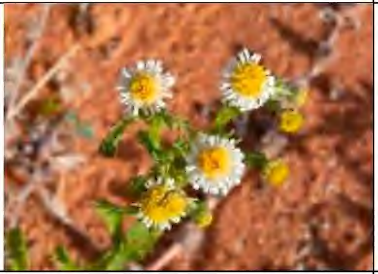
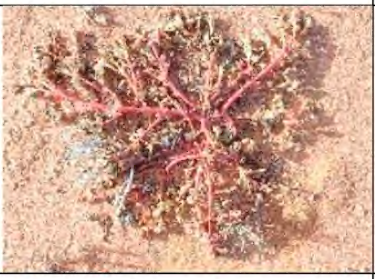


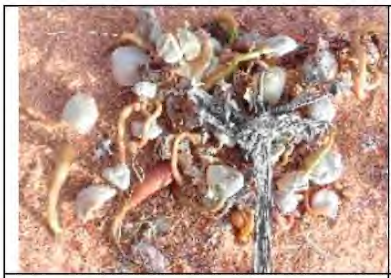
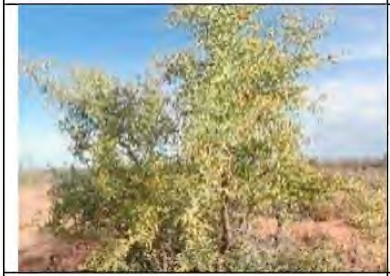
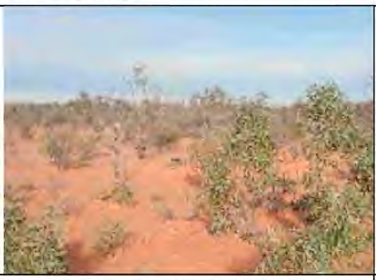
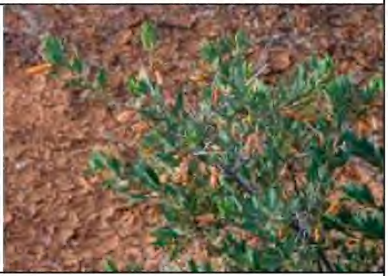
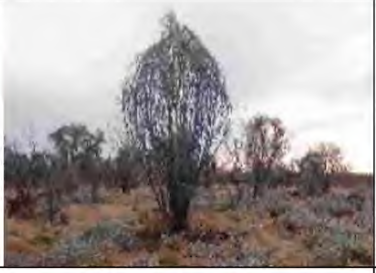
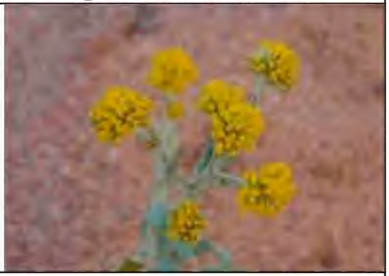
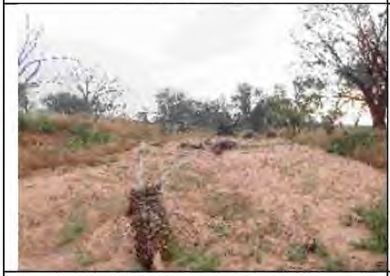
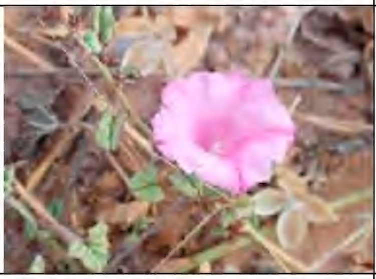
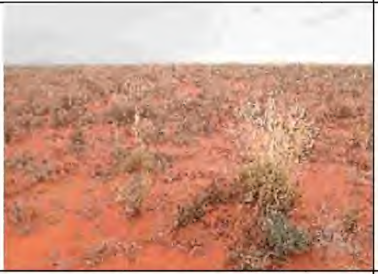
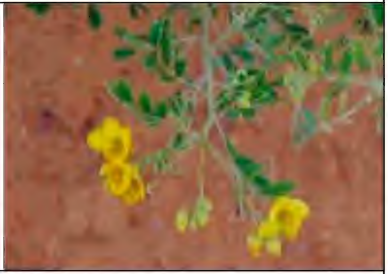
Swainsona villosa

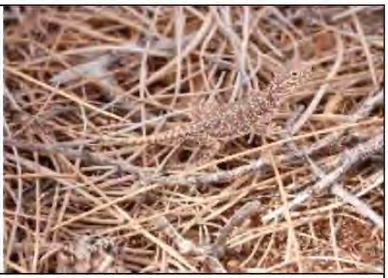
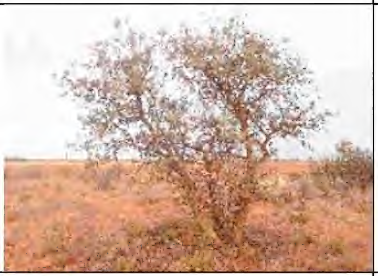
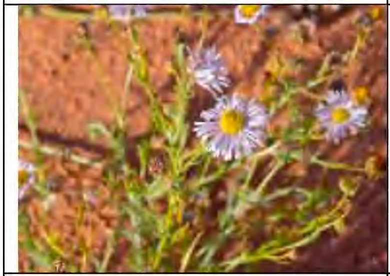
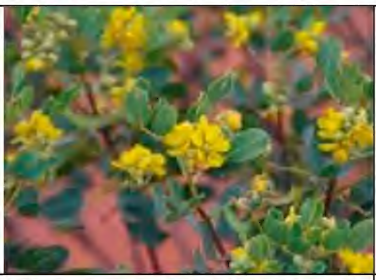
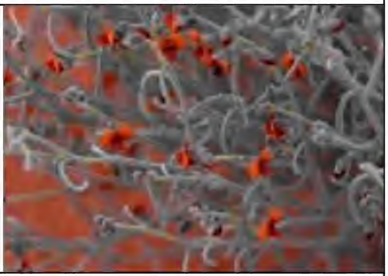
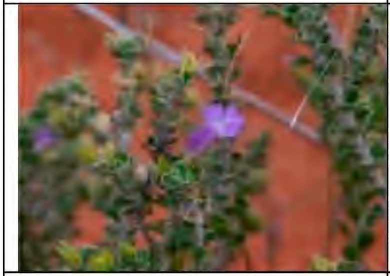
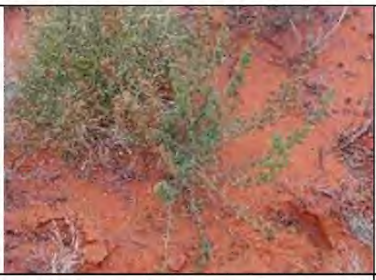
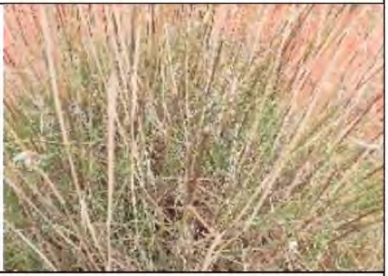
Zebra Finches at Leap Year Dam		
Transect E	Habitat: Sand plain with tussock grasses. 50% cover	
Camel scats	*Acacia ligulata,* Dune Wattle	*Oxychloris scariosa*
Atalaya hemiglauca, Cattle Bush	*Gnephosis eriocarpa*	
Transect F	Habitat: Sand plain with saltbush and tussock grasses. 50% cover.	
Scats containing fibrous vegetable matter.	*Streptoglossa adscendens*, Desert Daisy	
Transect G	Habitat: Sand/clay plain. 60% cover	
Small shrubs and ephemral herbs	*Euphorbia sp.*	

		
Goodenia sp.		
Transect H	Habitat: Sand plain with tussock grasses and some saltbush. 70% cover.	
		
Calandrinia sp.	*Lepidium sp.*	*Acacia tetragonophylla,* Dead Finish, Recovering after drought.

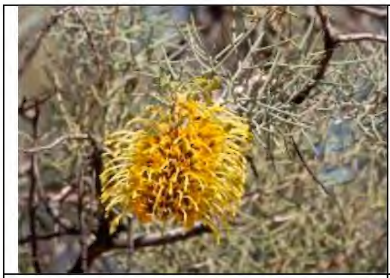
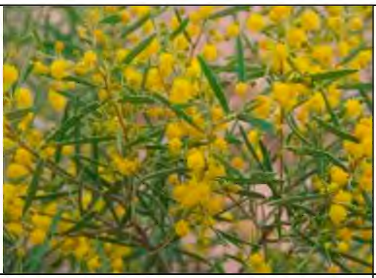
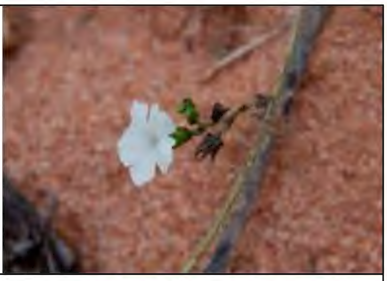
Census stop: **CR05 (A-D)** Date: 30/07/2022 Start time: 15:25
CR05 (E-H) 31/07/2022 Start time: 15:50
Weather: 90% cloud, moderate wind.
Number of observers: 4
Habitat: Sand plain and low dunes. Wooded creek-line diagonally through the site.

Transect A	Habitat: Sand plain tussock grasses. Red Mulga and Coolibah at creek	
		
Goodenia sp.	*Tribulus,* Devil Thorns	Buffel Grass at Dripie Ck
		
Arabidella eremigena	*Blennodia canescens*	*Cullen australasicum,* Native Scurf-Pea
		
Trees along Dripie Creek.	*Eremophila obovata*	*Swainsona sp.*
		
Swainsona sp.	*Gnephosis eriocarpa*	Grass on clay pan
		
Calotis, Bur-Daisies	*Portulaca oleracea,* Pigweed	Water erosion on sand plain

		
Crinum flaccidum, Andamooka Lily		
Transect B	Habitat: Sand plain, grassland with scattered shrubs. 60% cover	
		
Acacia victoriae, Gundabluie	Open shrubland	*Eremophila maculata,* Spotted Emu Bush
		
Trichonephila edulis, Australian Golden Orbweaver	Dead Acacias	*Rhodanthe moschata,* Musk Sunray
		
Dripie Creek with Buffel Grass	*Ipomoea muelleri*, Poison Morning Glory	
Transect C	Habitat: Sand plain with tussocks and scattered dead shrubs. 50% cover	
		
Triodia basedowii on sand plain	Ant nest	*Senna artemisioides, ssp. oligophylla*

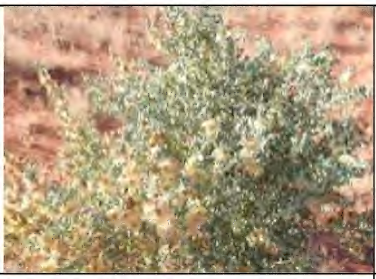
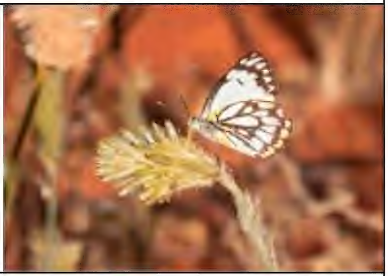
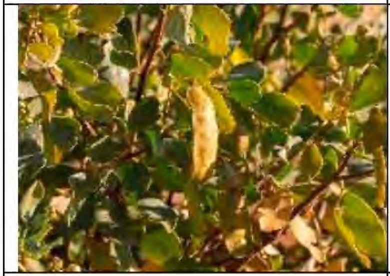
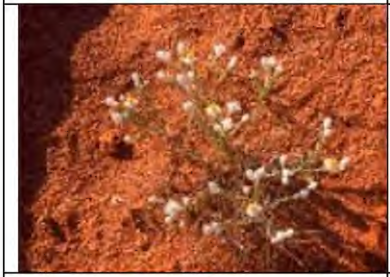
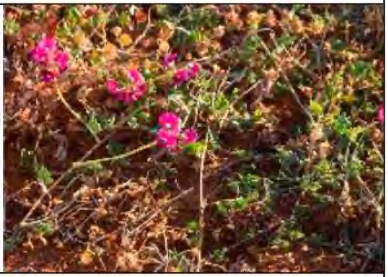
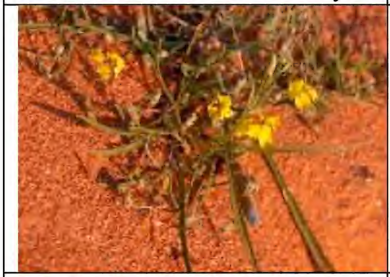
		
Well defined cattle track	Diamond dove scats clustered at resting sites	*Ctenophorus nuchalis,* Central Netted Dragon
Transect D	Habitat: Sand plain and gibber with patch tussock grass. 40% cover	
		
Hakea eyreana, Straggly Corkbark	Large sedge	
		
Calotis, Bur-Daisies		
Transect E	Habitat: sand/flood plain with gibber and tussocks rising to low dune. 50% cover	
		
Sand plain with low shrubs	*Senna artemisioides, ssp. oligophylla*	*Isotropis wheeleri*
Transect F	Habitat: Dune with sparse shrubs and Triodia. Cover 50%	
		
Eremophila obovata	*Salsola australis,* Australian Tumbleweed	*Triodia basedowii,* Hard Spinifex, in flower

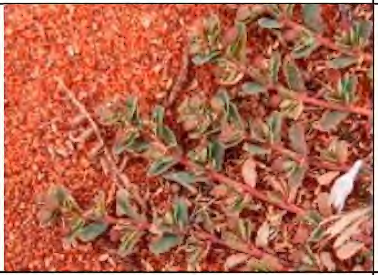
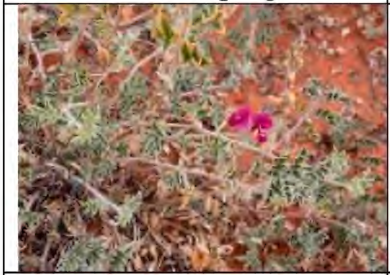
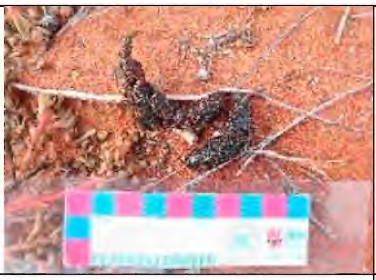
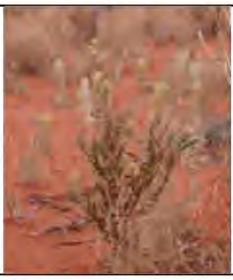
Atalaya hemiglauca, Cattle Bush regeneration		
Transect G	Habitat: Low dune with Senna and scattered Eucalypts near creek. 30% cover	
Erosion gullies near creek.	Buffel Grass near creek heavily grazed by cattle.	
Eucalyptus coolabah, Coolibah along creek	Cattle trampling and dead trees.	*Datura leichhardtii,* Devil's Trumpets along creek.
Acacia cyperophylla, Red Mulga woodland		
Transect H	Habitat: Sand plain, tussock grass and red mulga woodland. Cover 50%	
Kangaroo scats	*Scaevola spinescens,* Spiny Fan-Flower	*Dissocarpus paradoxus,* Cannonball Burr

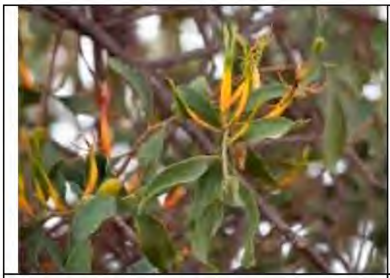
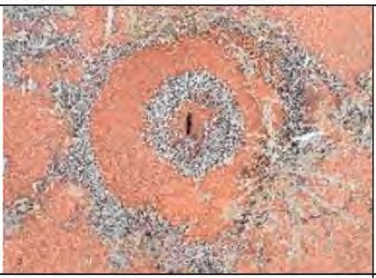
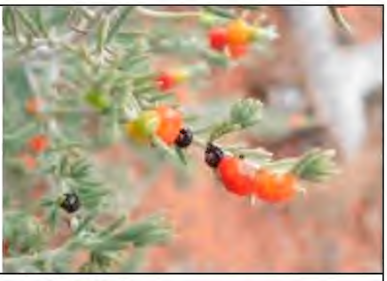
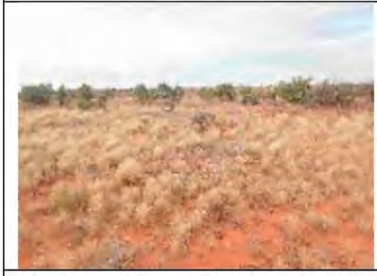
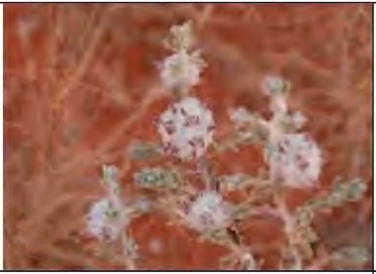
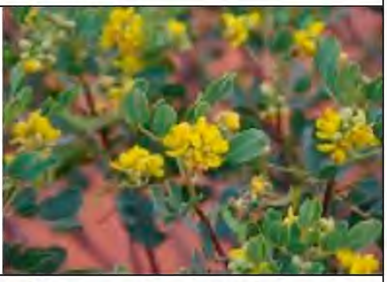
		
Hakea eyreana, Straggly Corkbark	*Acacia ligulata*, Dune Wattle	*Convolvulaceae*

Census stop: CR06 (A-D) Date: 01/08/2022 Start time: 16:00
CR06 (E-H) 02/08/2022 Start time: 16:00
Weather: Light breeze, day 1, 90% cloud, day 2, 0% cloud. 25C
Number of observers: 4
Habitat: Low dunes and sand plains. Small clay pans. Tussock grasses and scattered shrubs

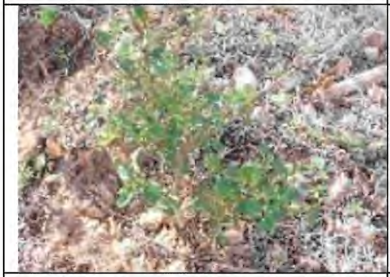
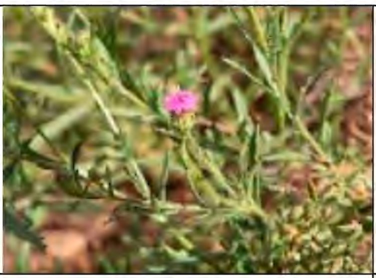
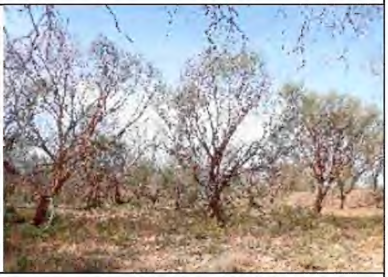
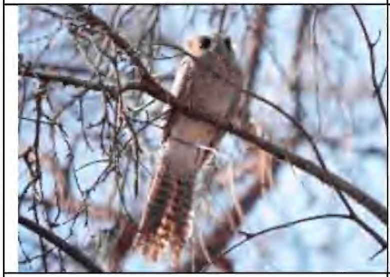
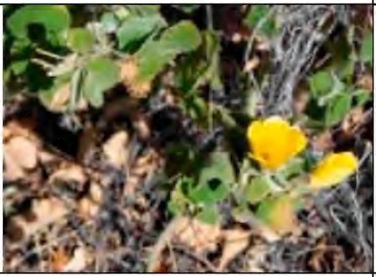
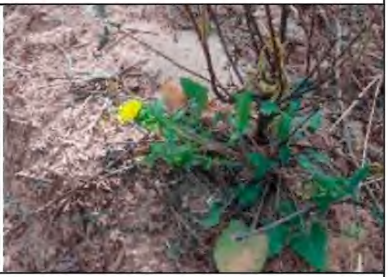
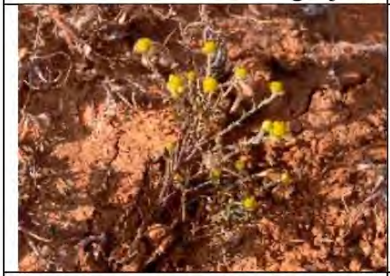
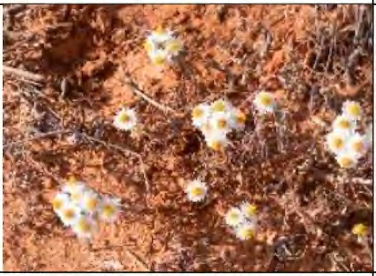
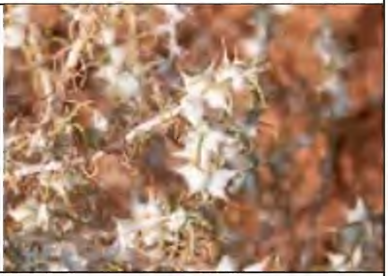
Transect A	Habitat: Sand plain, tussock grasses and scattered mulga. 90% cover	
Dead Mulga, *Acacia aneura.*	Bird tracks	*Swainsona sp.*
Well vegetated sand plain	*Trachymene glaucifolia*	
Transect B	Habitat: Sand plain with tussock grasses and scattered shrubs. 60% cover	
Acacia tetragonophylla, Dead Finish	*Maireana sp.*	*Corymbia terminalis,* Desert Bloodwood
Marsilea sp. Nardoo		

Transect C [redacted]	Habitat: Tussock grassland. Many dead trees. 70% cover	
		
Cattle track and dead shrubs.	*Maireana sp.*	*Belenois java.* Caper White
		
Senna artemisioides, ssp. oligophylla		
Transect D	Habitat: Sand plain, tussock grass & dead trees. Part on road, rest 70% cover	
		
Rhodanthe floribunda, Common White Sunray	Nardoo and Swainson peas on a clay pan.	*Swainsona oligophylla*
		
Goodenia	Tussock grasses in flower.	
Transect E	Habitat: Sand plain, tussock grasses and scattered mulga.	
Sand plain with scattered shrubs.	Diamond dove scats.	Termite nest

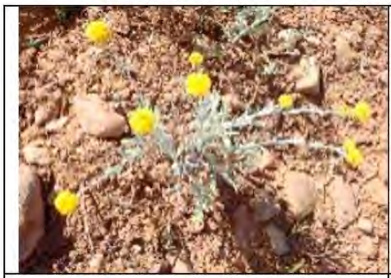
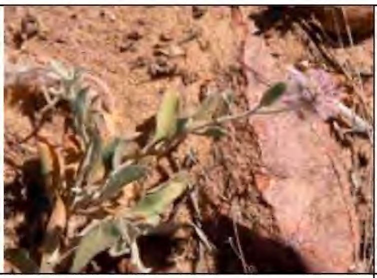
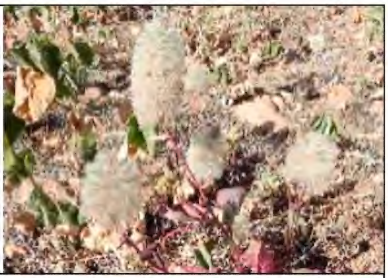
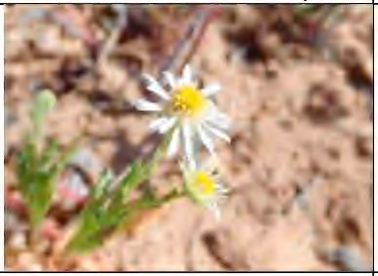
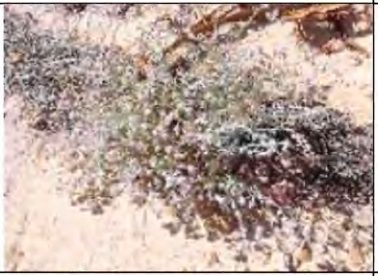
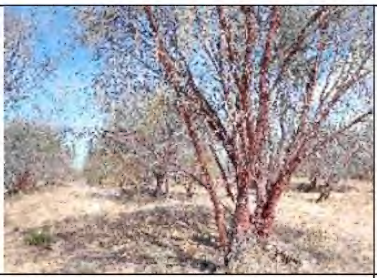
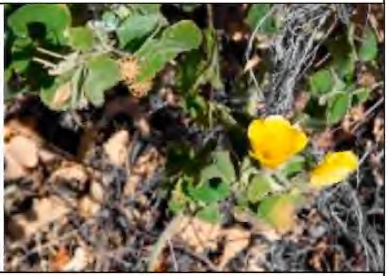
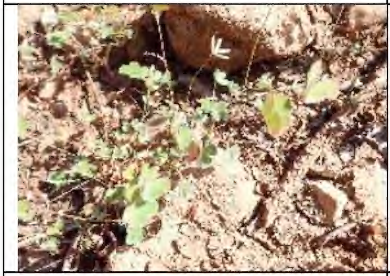
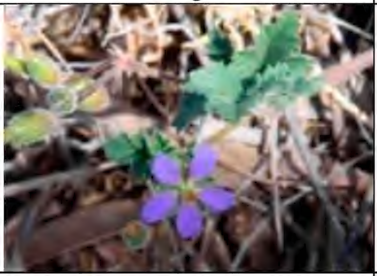
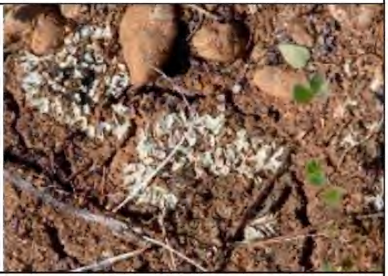
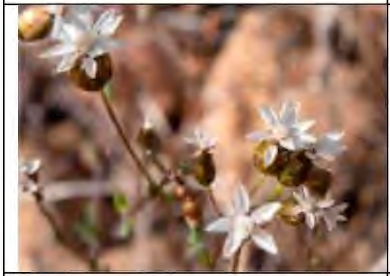
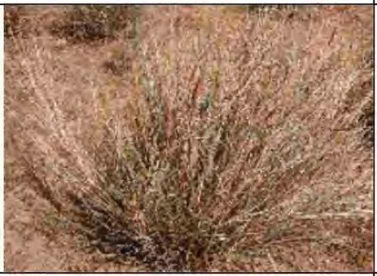
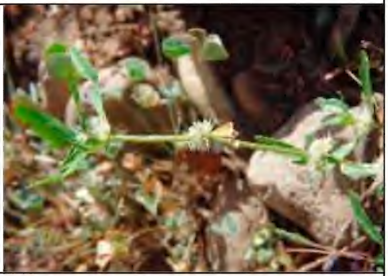
Ptilotus and tussock grasses.		
Transect F	Habitat: Sand plain, tussock grasses and scattered shrubs. Cover 60%	
Dead Triodia (fire?)	Cattle track	Regenerating *Triodia.*
		
Euphorbia drummondii, Caustic Spurge	Grasses.	
		
Swainsona sp.		
Transect G	Habitat: Sand plain with tussock grasses. 50% cover	
		
Termite mound, small mammal burrow and *Portulacca.*	Scat containing plant remains.	*Ptilotus polystachyus*, Prince of Wales Feather

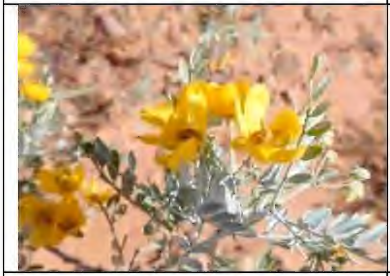
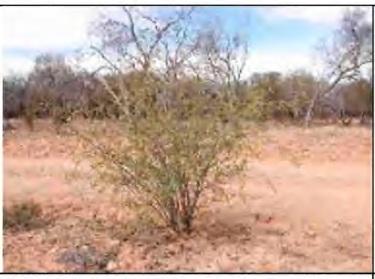
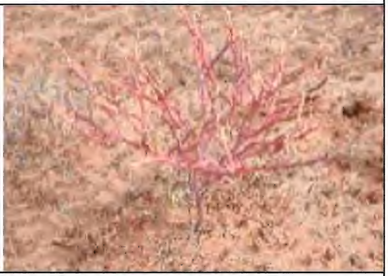
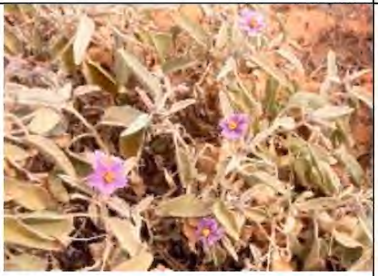
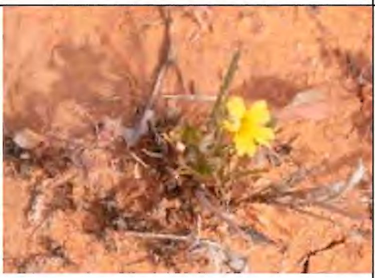
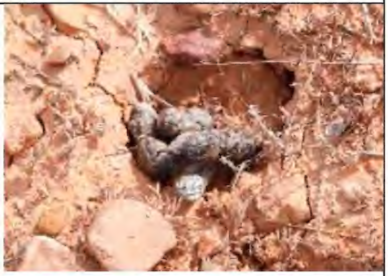
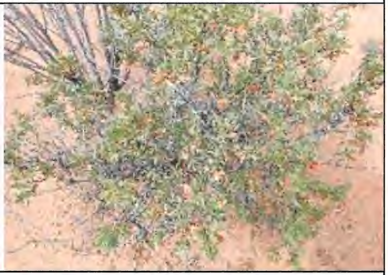
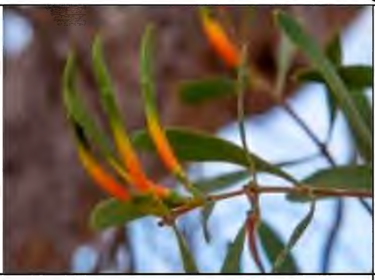
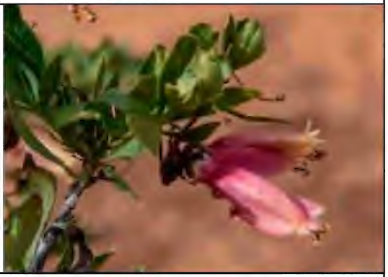
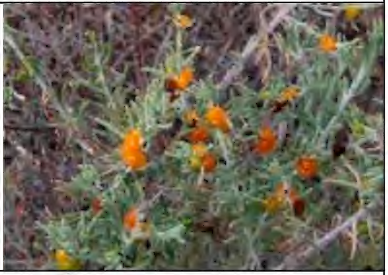
		
Lysiana exocarpi, Harlequin Mistletoe	Ant nest with discarded seed husks.	*Enchylaena tomentosa,* Barrier Saltbush
Transect H	Habitat: Sand plain with tussock grasses, Cattle bush regen, dead Acacia. 60% cover.	
		
Atalaya hemiglauca, Cattle Bush regeneration	*Dissocarpus paradoxus,* Cannonball Burr	*Senna artemisioides, ssp. oligophylla*

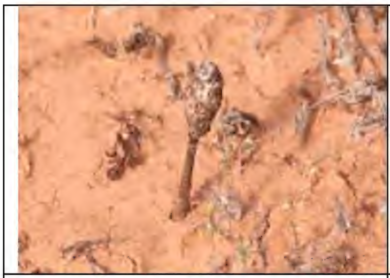
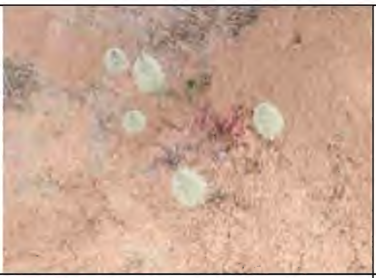
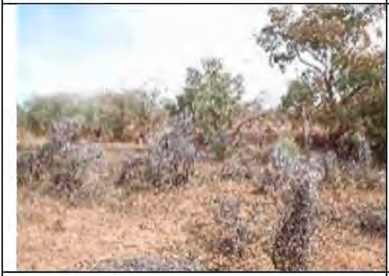
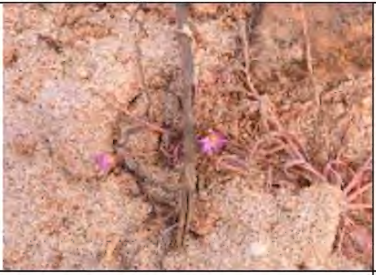
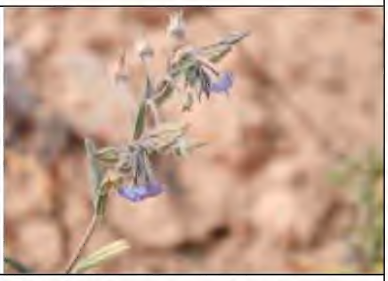
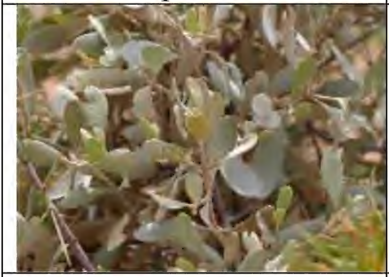
Census stop: CR07 Date: 30/07/2022 Start time: 09:35
Weather: Strong wind, 90% high cloud
Number of observers: 4
Habitat: Gibber plain with wooded creek line.

Transect A	Habitat: Gibber plain, creek line with Red Mulga	
		
Cullen australasicum, Native Scurf-Pea. Heavily browsed.	*Asteraceae*	*Acacia cyperophylla*, Red Mulga along creek.
		
Aegotheles cristatus, Australian Owlet-Nightjar	*Abutilon leucopetalum,* Desert Chinese Lantern	*Sonchus oleraceus,* Common Sow-Thistle
		
Gnephosis arachnoidea	*Rhodanthe floribunda,* Common White Sunray	*Sclerolaena bicornis,* Goathead Burr
Edge of gibber field and clay pan.	Rabbit scats	

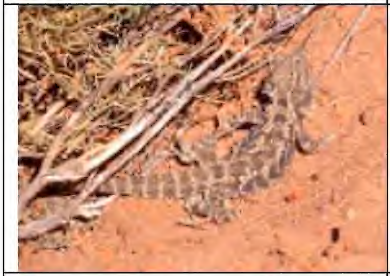
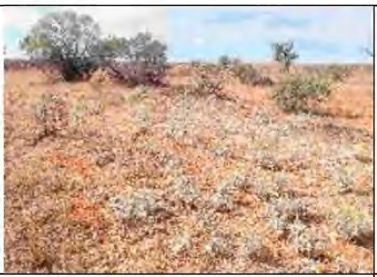
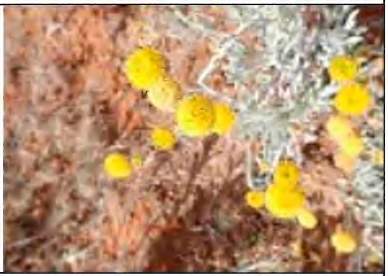
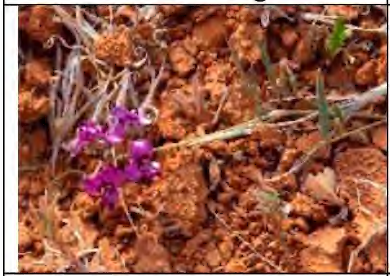
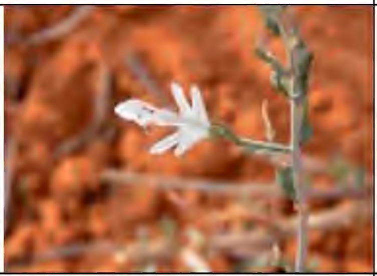
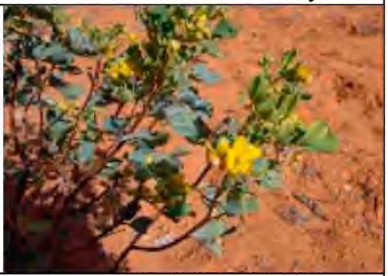
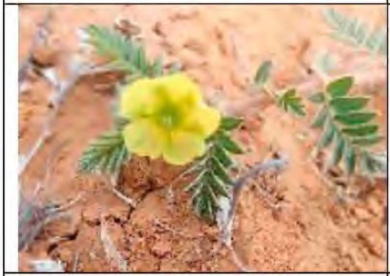
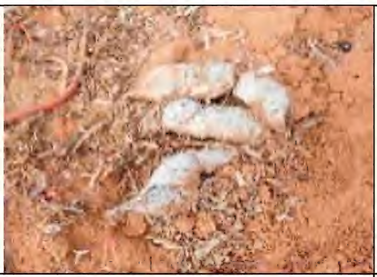
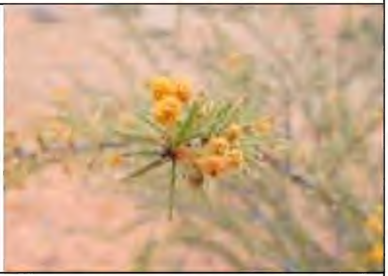
Transect B	Habitat: Gibber plain with saltbush, 10% cover	
Goodenia sp.	*Atalaya hemiglauca*, Cattle Bush regeneration	*Senna artemisioides, ssp. oligophylla*
Gibber plain	*Atriplex spongiosa*, Pop Saltbush	
Transect C	Habitat: Gibber Plain. 30% cover	
Ephemeral stream with tussocks, saltbushes and Cattle bush.	*Maireana sp.* (front) and *Atalaya hemiglauca* regeneration (rear)	*Bulbine alata*
Maireana campanulata	*Ipomoea muelleri,* Poison Morning Glory	*Acacia tetragonophylla,* Dead Finish
Sclerolaena divaricata, Tangled Copper-burr	Dead Red Mulga along creek line	*Acacia cyperophylla*, Red Mulga regeneration.

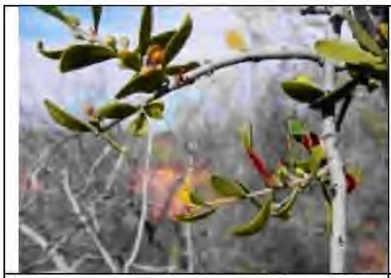
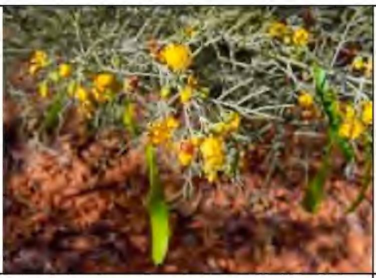
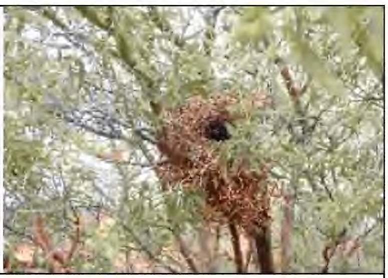
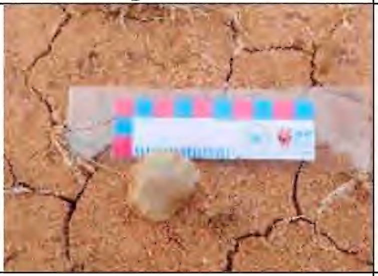
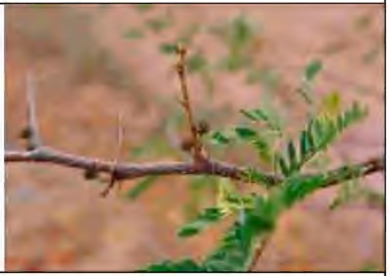
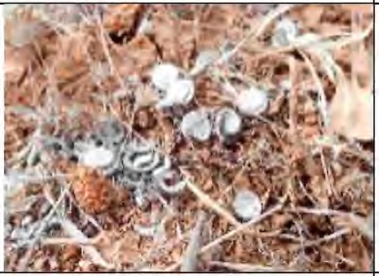
		
Leiocarpa leptolepis, Stalked Plover-Daisy	*Ptilotus sessilifolius,* Crimson Foxtail	*Ptilotus nobilis,* Yellow Tails
		
Calotis sp.		
Transect D	Habitat: Gibber plain and creek line. 40% cover.	
		
Ptilotus sessilifolius, Crimson Foxtail	*Acacia cyperophylla*, Red Mulga.	*Abutilon leucopetalum,* Desert Chinese Lantern
		
Marsilea sp., Nardoo	*Erodium crinitum,* Blue Stork's-Bill	*Riccia sp.,* Crystalwort
		
Rhodanthe stricta, Slender Sunray	*Eulalia aurea,* Water Grass	*Alternanthera denticulata*, Lesser Joyweed

Transect E	Habitat: Gibber plain. 10% cover.	
		
Senna artemisioides	*Vachellia farnesiana,* Sweet Acacia	*Euphorbia sp.*
		
Solanum lithophilum	*Goodenia sp.*	*Felis catus,* Feral Cat scat
Transect F	Habitat: Gibber plain. 10% cover.	
		
Lizard burrow	Gibber Plain	*Eremophila maculata,* Spotted Emu Bush
Transect G	Habitat: Clay pan, scattered shrubs, very few herbs, creek bed with mulga. 10% cover	
		
Flood plain at edge of creek.	*Lysiana exocarpi,* Harlequin Mistletoe	*Eremophila maculata,* Spotted Emu Bush
		
Buffel Grass along creek	*Acacia cyperophylla*, Red Mulga	*Enchylaena tomentosa,* Barrier Saltbush

		
Podaxis pistillaris, Desert Shaggymane	*Ptilotus nobilis,* Yellow Tails	
Transect H	Habitat: Sand plain with flood plain and creek. 10% cover away from creek.	
		
Dead Acacia on flood plain	*Calandrinia sp.*	*Trichodesma zeylanicum,* Camel Bush
		
Amyema maidenii, Green Mistletoe		

Census stop: CR08 Date: 29/07/2022 Start time: 10:50
Weather: Moderate wind, 30% high cloud, 18C
Number of observers: 5
Habitat: Sand plain with open shrubs and small water courses, gibber plain.

Transect A	Habitat: Sand plain with scattered shrubs.	
		
Pogona vitticeps, Central Bearded Dragon	Sand plain.	*Leiocarpa leptolepis*, Stalked Plover-Daisy
		
Swainsona sp.	*Teucrium racemosum,* Grey Germander	*Senna artemisioides, ssp. oligophylla*
Cattle track	Cattle.	
Transect B	Habitat: Sand plain to Gibber plain	
		
Tribulus sp. Devil Thorns	Cat scats	*Acacia tetragonophylla,* Dead Finish.

		
Lysiana exocarpi, Harlequin Mistletoe	*Senna artemisioides*	Zebra finch nest
		
Worked stone flake		
Transect C	Habitat: Gibber plain, sparse cover of ephemeral herbs.	
		
Cattle tracks	Cattle	*Vachellia farnesiana,* Sweet Acacia
Sand plain with open shrubs.		
Transect D	Habitat: Sand plain with shallow water courses.	
		
Diamond dove scats clustered at resting sites	Ephemeral water course.	*Vachellia farnesiana,* Sweet Acacia

Transect E	Habitat: Sand plain with scattered shrubs. 20% cover	
Atalaya hemiglauca, Cattle Bush regeneration	Termite mound	*Podaxis pistillaris,* Desert Shaggymane
Stone spear point	Cattle track on clay pan	*Eremophila obovata*
Lizard burrow	*Hakea eyreana,* Straggly Corkbark	
Transect F	Habitat: Sand plain with scattered shrubs.	
Ptilotus polystachyus, Prince of Wales Feather		
Transect G	Habitat: Sand plain with low *Eremophila*. Cover 10%	
Sand plain with low shrubs		

Transect H	Habitat: Sand plain with sparse shrubs and tussock grasses.	
Eremophila obovata	Cattle tracks across sand plain	*Ptilotus polystachyus,* Prince of Wales Feather

APPENDIX V – CLIMATE

The area surveyed falls within the arid zone of north-east South Australia.

1. Rainfall

The closest weather station to the survey area is Bureau of Meteorology (BOM) station number 17028 at Innamincka Station. The rainfall record for this station goes back to 1883, but records are incomplete, with data for several months missing especially for 2016, 2019 and 2020 (see Fig 6ii). The nearest station with recent records is the Moomba Airport station, number 17123, about 66 km south-west of Innamincka, for which complete records are available from 1996. Fig. 6 shows a comparison of the monthly rainfall data for these two stations since 1996. For both sites, the annual rainfall is seen to be extremely variable, although overall the trendline for Moomba shows little change. The BOM gives the mean annual rainfall for Innamincka as 178.3 mm and for Moomba as 173.0 mm.

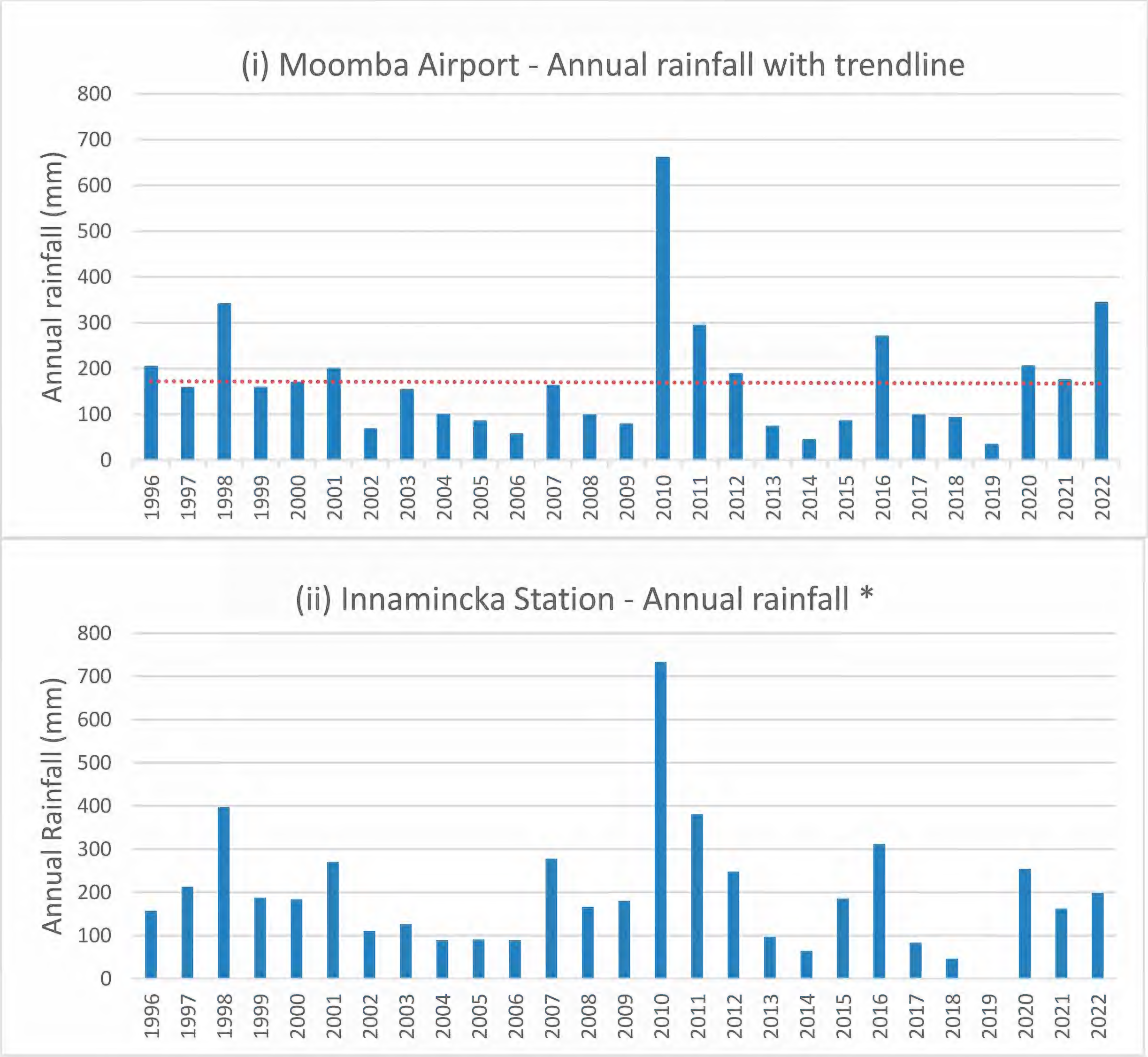


Fig. 6. Rainfall totals per year since 1996. Source: Bureau of Meteorology.
*Records missing for Innamincka – 1 month for 6 of the years shown, 4 months for 2016, 11 months for 2019 and 3 months for 2020; totals for available data shown but trendline unreliable.

Of particular relevance for this project are the rainfall records for the 12 months preceding the survey period. Fig. 7 shows that there were several small rainfall events recorded in these 12 months, a moderate rainfall at 3 months and a larger rainfall at 6 months. Fig. 8 shows a comparison of the overall rainfall data for the region for the years leading up to both the baseline (2017) and repeat (2022) surveys, revealing increasing rainfall over the 4 years prior to the 2017 survey, but then drier conditions until the repeat survey year.

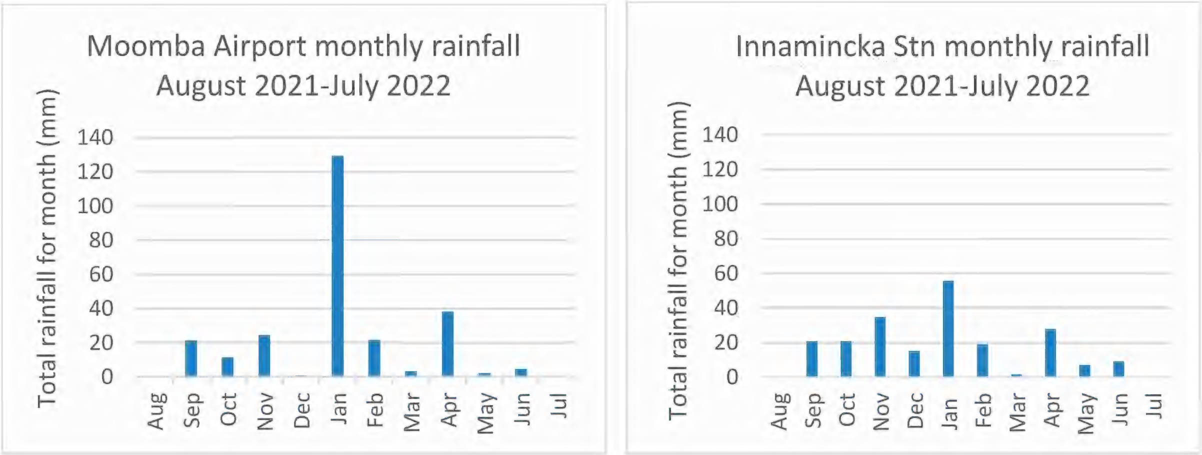


Fig. 7 Monthly rainfall for the 12 months preceding the 2022 survey (Aug 21-July 22)
Source: Bureau of Meteorology.

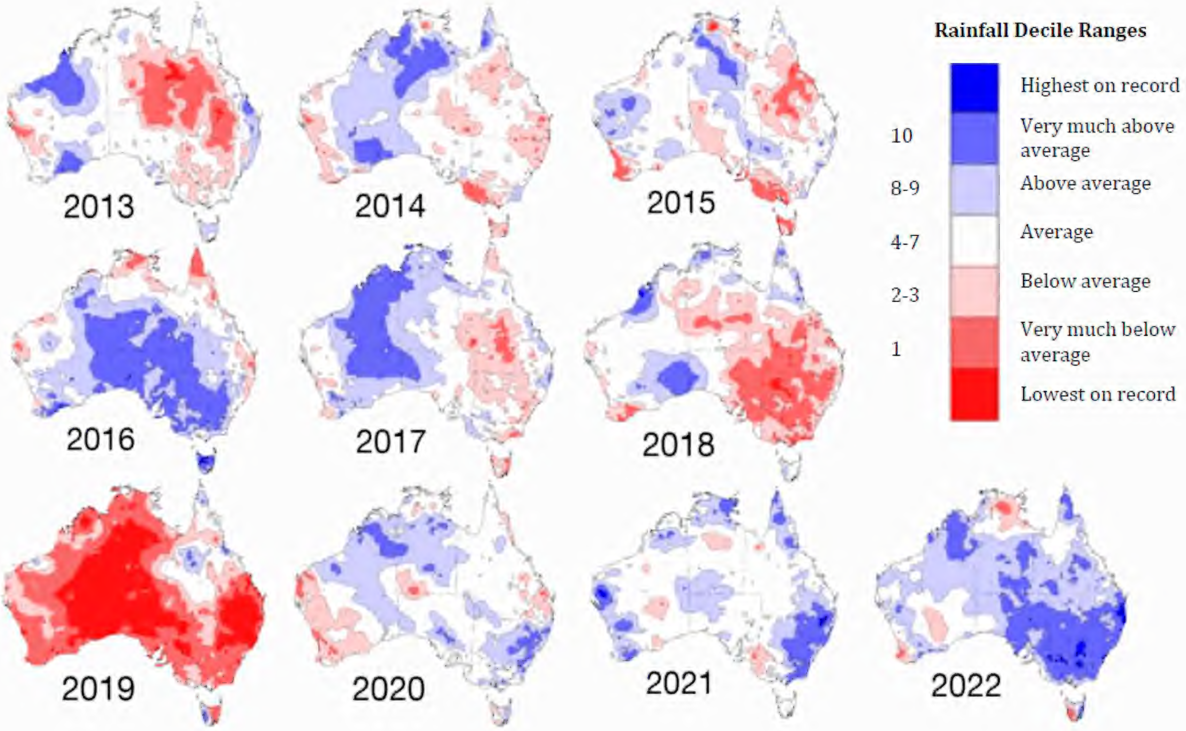


Fig. 8 Maps showing the decile rank of rainfall for each calendar year (2013-2022) based on 120 years of rainfall data[10]**.**
Source: Bureau of Meteorology

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[10] **Deciles** are used to give an element a ranking. If, for example, you had 40 years of annual rainfall records, you would first arrange the totals in ascending order (from lowest to highest). Next split them into 10 equal groups, so that in this example there would be 10 groups of four. The first group (four lowest annual rainfalls on record) would be in decile range one, the second group in decile range two, up to the four highest annual totals (highest 10 per cent) being in decile range 10.

2. Temperature

The closest weather station to the survey area that records temperature is Bureau of Meteorology station number 17123 at Moomba Airport. The temperature records go back to 1996. There has been an upward trend in mean daily maximum temperature per year over the period records have been collected, although cooler temperatures in the last few years when there was also relatively good rainfall (Fig. 9). These changes are paralleled in the 12-month mean temperature anomalies compared to a reference period (1961–1990) for the region over this period (Fig. 10).

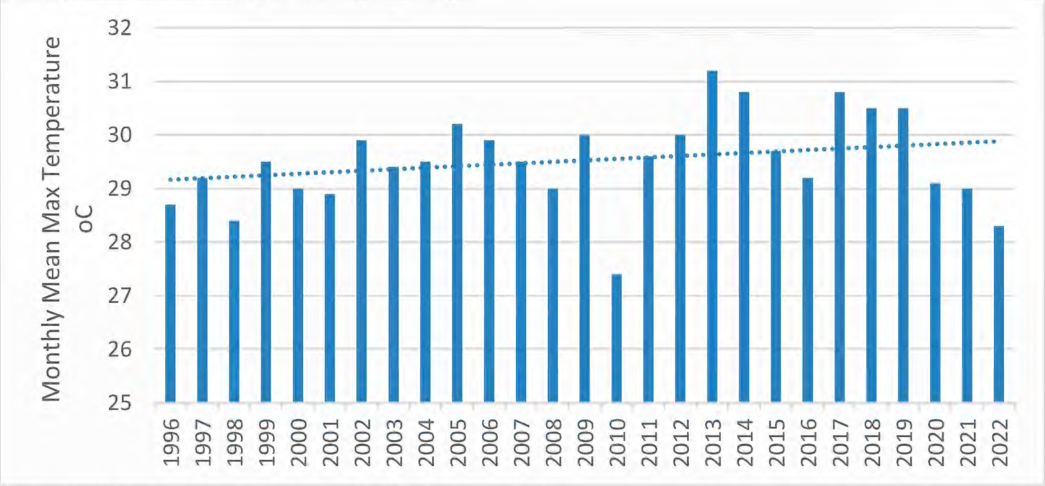


Fig. 9 Moomba Airport (17123) monthly mean maximum temperature with trend (1996-2022). The monthly mean maximum temperature is the average of all available daily maxima for the month. The daily maximum air temperature is nominally recorded at 9 am local clock time. It is the highest temperature for the 24 hours leading up to the observation, and is recorded as the maximum temperature for the previous day. **Source**: Bureau of Meteorology

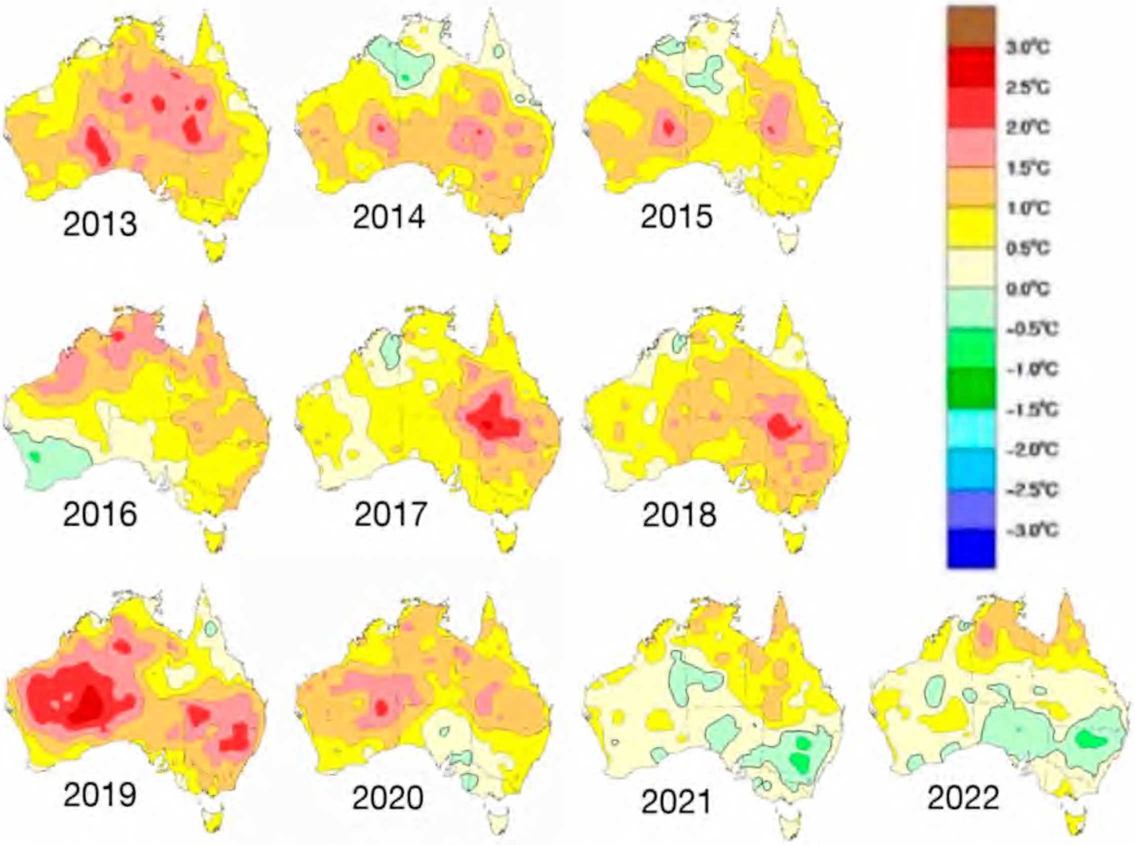


Fig. 10 12-monthly mean temperature anomaly
These maps show the anomaly of mean temperature (°C) for each calendar year, compared to the average over the standard reference period of 1961–1990.
Source: Bureau of Meteorology

APPENDIX VI – USING A GPS TO NAVIGATE TRANSECT SQUARES

Each survey team needs to have at least one member with a GPS unit and some basic skills in using it. Given that a variety of GPS units will be brought to the survey task by different volunteers, the following guidelines are generic in nature.

Two alternative methods are given below for navigating the two transect squares for each census stop.

Preliminary Skills

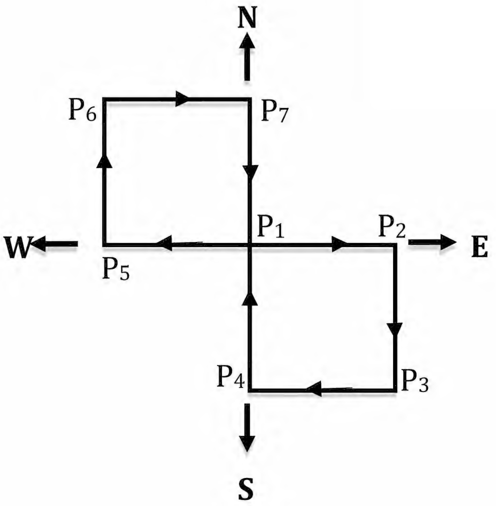
Users should come to the task knowing how to:

1. set up their GPS units to locate positions using
   (a) metric units
   (b) UTM position format
   [for the Innamincka area the UTM zone/band is 54J and the position is given by a 6 or 7 digit **easting** (depending on whether or not the leading zero is shown) and and a 7 digit **northing**. E.g. 54J 0467632 6929509. These numbers may appear on two lines, with the easting on the top line. The "54J" may or may not be shown]
2. mark and find waypoints
3. show, not necessarily on the same page/screen
   (a) the easting and northing for the current position
   (b) the distance from a given waypoint

METHOD 1

Navigating Transect Squares

Starting at census stop 1 corner point 1 (P_1 in the diagram), the survey consists of two transect squares with the 500 m sides oriented along the principal compass directions as shown.



1. Mark P_1 as a waypoint on the GPS unit (e.g. call it waypoint 101). Record the easting and northing in a notebook (see Table below).
2. Select "Find" or "GoTo" waypoint 101 – your unit should tell you that you are already there!
3. Walk in an easterly direction by keeping the northing constant (you may need to adjust it by veering southwards to reduce the northing to the desired value, or by veering northwards to increase the northing to the desired value). It is not necessary to be exactly due east of P_1 at all times so it is quite OK to make detours around obstacles such as thorn bushes!
4. While proceeding eastwards, check your distance from P_1 from time to time. When this distance approaches 500 m adjust your position so that your northing is the same as at P_1 and your distance from P_1 is exactly 500 m. Mark this point as P_2 (e.g. waypoint 102) and record the easting and northing in your notebook.
5. Repeat the above process to locate P_3, 500 m south of P_2. This time you will need to keep the easting constant and the northing will decrease as you go.
6. Repeat the above process for each side of the two transect squares.

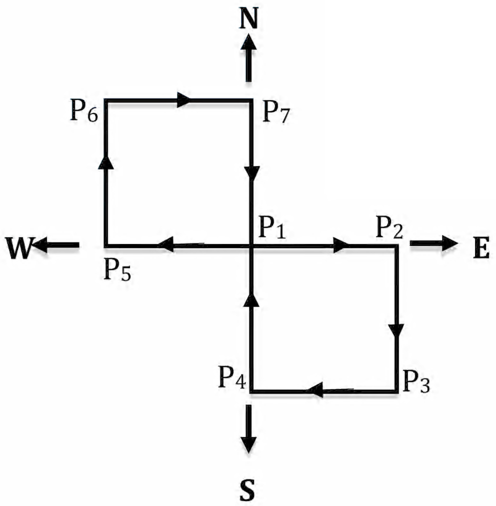
Notes

- Eastings get larger as you move eastwards and smaller as you move westwards. Northings get larger as you move northwards and smaller as you move southwards.
- A possible format for your record book is shown. Note that eastings and northings are alternatively equal as you move from one point to the next.

Census stop 1 Waypoints

Waypoint	Easting	Northing
101 (P_1)	a	b
102 (P_2)	c	b
103 (P_3)	c	d
104 (P_4)	a	d
101 (P_1)	a	b
105 (P_5)	e	b
106 (P_6)	e	f
107 (P_7)	a	f
101 (P_1)	a	b

METHOD 2



Navigating Transect Squares

Starting at census stop 1 corner point 1 (P_1 in the diagram), the survey consists of two transect squares with the 500 m sides oriented along the principal compass directions as shown.

1. Mark P_1 as a waypoint on the GPS unit (e.g. call it waypoint 101). In a notebook draw up a table as shown below and record the easting (‘e’) and northing (‘n’) of P_1.
2. Calculate the eastings and the northings for the other seven corner points of the survey squares by adding or subtracting 500 as shown by the formulas in the table. Enter all eastings and northings on your table.

Census Stop 1 Waypoints

Waypoint	Easting	Northing
101 (P_1)	e	n
102 (P_2)	$e+500$	n
103 (P_3)	$e+500$	$n-500$
104 (P_4)	e	$n-500$
101 (P_1)	e	n
105 (P_5)	$e-500$	n
106 (P_6)	$e-500$	$n+500$
107 (P_7)	e	$n+500$
101 (P_1)	e	n

3. Walk in an easterly direction by keeping the northing constant (you may need to adjust it by veering southwards to reduce the northing to the desired value, or by veering northwards to increase the

northing to the desired value). It is not necessary to be exactly due east of P_1 at all times so it is quite OK to make detours around obstacles such as thorn bushes!

4. While proceeding eastwards, monitor the easting of your current position. When this approaches the desired easting (*e*+500) adjust your position so that your northing is the same as at P_1 (*n*) and your easting is exactly (*e*+500). You have now reached the point P_2 (waypoint 102).
5. Repeat the above process to locate P_3, 500 m south of P_2. This time you will need to keep the easting constant and the northing will decrease as you go.
6. Repeat the above process for each side of the two transect squares.

Note

- Eastings get larger as you move eastwards and smaller as you move westwards. Northings get larger as you move northwards and smaller as you move southwards.
- Example calculation:

Census Stop 1 Waypoints

Waypoint	**Easting**		**Northing**	
101 (P_1)	*e*	0431028	*n*	6953816
102 (P_2)	*e*+500	0431528	*n*	6953816
103 (P_3)	*e*+500	0431528	*n*-500	6953316
104 (P_4)	*e*	0431028	*n*-500	6953316
101 (P_1)	*e*	0431028	*n*	6953816
105 (P_5)	*e*-500	0430528	*n*	6953816
106 (P_6)	*e*-500	0430528	*n*+500	6954316
107 (P_7)	*e*	0431028	*n*+500	6954316
101 (P_1)	*e*	0431028	*n*	6953816

While it would be possible to manually input these co-ordinates into the GPS unit and to then use the “Find” or “GoTo” function, the process would be time-consuming and tedious and the following of the direction arrow is not likely to give a more precise transect square than the method of maintaining eastings and northings detailed above.

APPENDIX VII - EQUIPMENT LIST

- EPIRB (if you have one) or Satellite phone (if you have one).
- Hand-held UHF radio for staying in contact while surveying (*to be carried on your person at all times when out of the car, along with at least one set of spare batteries*).
- GPS for each group (*to be carried at all times when out of the car, along with at least one set of spare batteries*).
- Compass (*to be carried on your person at all times when out of the car*).
- Plenty of spare batteries.
- Survey sheets and a clip board, notebook and pencils.
- Watch for telling the time (or use GPS clock)
- Digital camera with large memory card. Set camera clock to local time to enable you to better relate photos to location.
- Small ruler or measuring card for photographing with tracks etc.
- Car chargers for the various pieces of electronic equipment / rechargeable batteries.
- Star picket / dropper, plastic dropper cap, star dropper plunger.
- Census stop marker plate stamped for census stop e.g. FOIR CS01, bolt, washer and nut, spanner.
- Personal protective equipment (PPE).
- First Aid kit including snake bite kit.